MINERALOGICAL ABSTRACTS

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X-rays and Crystal-structure.

LÁNYI (Béla). *Röntgensugarak és kristályszerkezet.* [Röntgen rays and crystal-structure.] Magyar Chem. Folyóirat, Budapest, 1928, vol. 34, pp. 194–210, 10 figs.

A useful account for general readers of the various X-ray methods for determining the structure of crystals. K. Z.

BRAGG (W. Lawrence). *The determination of parameters in crystal structures by means of Fourier series.* Proc. Roy. Soc. London, Ser. A, 1929, vol. 123, pp. 537–559, 3 figs.

The representation of the scattering matter in a crystal by Fourier series is used to find the positions of the atoms in complex substances. A series is used giving the projection of the scattering matter in the unit cell on each of its faces in turn. The method is applied to diopside whose structure has already been determined [M.A. **4**–31]. It appears that much time is saved and the precise position of the atoms may be arrived at directly. F. A. B.

ASTBURY (W. T.). *A new integrating photometer for X-ray crystal reflections, etc.* Proc. Roy. Soc. London, Ser. A, 1929, vol. 123, pp. 575–602, 1 pl., 12 text-figs.

The theory of this instrument and details of the technique are presented more completely [M.A. **3**–521]. Direct proportionality is obtained between the X-ray intensities used to make the negative and the α-ray ionizations observed in the electroscope. Successful experimental tests of the integrating properties of this instrument, both for real and artificial X-ray spots are described. It is shown how its use may be extended to the measurements of α-, β-, and γ-rays, and also of visible light. F. A. B.

GEORGE (Wm. H.). *On the interpretation of X-ray crystal photographs.—Part I. Use of photographic grids.* Phil. Mag., 1929, ser. 7, vol. 7, pp. 373–384, 1 pl., 2 text-figs.

Providing the plate or film is supported entirely by geometric constraints it is possible to impress together with the X-ray photograph an image of the network required for interpretation. This time-saving device is discussed in detail together with its various modified applications to X-ray crystallography. F. A. B.

Schneider (W.). *Über die graphische Auswertung von Aufnahmen mit dem Weissenbergschen Röntgengoniometer.* Zeits. Krist., 1928, vol. 69, pp. 41–48, 6 figs.

A graphical method, based upon the conception of the reciprocal lattice, is deduced for the interpretation of Weissenberg's rotation photographs (Zeits. Physik, 1924, vol. 23, p. 229). The method is simplified if the primary and diffracted beams make equal angles with the axis of the cylinder carrying the photographic film. F. A. B.

Böhm (J.) & Ganter (F.). *Über den Einfluß des Kristallhabitus auf das Debye-Scherrerdiagramm.* Zeits. Krist., 1928, vol. 69, pp. 17–25, 1 pl., 1 text-fig.

The authors discuss the effect upon powder photographs of the size of the particles, the absorption, and the orientation. Photographs of α-Fe_2O_3 and gold illustrate the influence of each factor. F. A. B.

Hengstenberg (J.) & Mark (H.). *Über Form und Größe der Mizelle von Zellulose und Kautschuk.* Zeits. Krist., 1928, vol. 69, pp. 271–284, 9 figs.

An account is given of the X-ray methods of determining the size and shape of particles. Applications were made to the substances cellulose, artificial silk, and india-rubber, which were found to have cells elongated in the direction of the axes of their threads. At the temperature of liquid air the coefficient of expansion for the direction parallel to these axes is appreciably less than for the perpendicular directions. H. H.

Wherry (Edgar T.). *New data on atomic dimensions.* Amer. Min., 1929, vol. 14, pp. 54–58.

The atomic radii of several chemical elements when positively charged, neutral, or negatively charged, as deduced by V. M. Goldschmidt (1926) and L. Pauling (1927), are tabulated and compared. L. J. S.

Allard (G.). *Sur un état allotropique de l'argent.* Compt. Rend. Acad. Sci. Paris, 1928, vol. 187, pp. 223–225.

Silver precipitated by copper from a silver nitrate solution does not show the characteristic X-ray lines (powder photograph method) of the ordinary cubic modification. It is shown to be orthorhombic with a unit rectangular cell of dimensions, $a = 4{\cdot}23$, $b = 5{\cdot}70$, and $c = 4{\cdot}91$ Å. The angle $(110) : (1\bar{1}0)$ therefore is 81° 30′. H. E. B.

Ebert (Fritz) & Hartmann (Hellmuth). *Die Kristallstruktur des Strontiums und Bariums.* Zeits. Anorg. Chem., 1929, vol. 179, pp. 418–420.

Powder photographs show that strontium is face-centred cubic with $a = 6{\cdot}05$ Å., while barium is body-centred cubic with $a = 5{\cdot}01$ Å. The atomic radii are 2·135 and 2·17 Å. respectively. L. J. S.

Mazza (L.) & Nasini (A. G.). *The crystal structure of nickel.* Phil. Mag., 1929, ser. 7, vol. 7, pp. 301–311, 1 pl.

Precision measurements by means of powder photographs were made in order to evaluate the lattice constant and structure of nickel, previous results being contradictory. Samples were prepared in different ways and subjected to various thermal treatments. The length of cubic cell-edge ranges from 3·513 to 3·515 Å., and the structure is always face-centred. F. A. B.

Westgren (A. F.) & Bradley (A. J.). *X-ray analysis of silver aluminium alloys.* Phil. Mag., 1928, ser. 7, vol. 6, pp. 280–288, 1 pl., 1 text-fig.

The equilibrium diagram for the Ag–Al alloys as found by Petrenko (1905) is confirmed. There are two intermediate phases at ordinary temperatures, viz. Ag_3Al and a solid solution of from 27 to 40 ' atomic percentages ' of aluminium. The former, with $a = 6{\cdot}920$ Å., contains 20 atoms, and from its close similarity to β-manganese two conclusions are drawn: (i) that β-manganese and Ag_3Al are isomorphous, and (ii) that β-manganese also contains 20 atoms, and not 160 as has been thought possible. The solid solution is hexagonal close-packed and the lattice dimensions vary with the percentage composition, the extremes being $a = 2{\cdot}865$ to 2·879, $c = 4{\cdot}653$ to 4·573 Å., as from 27% to 40% Al. It was not found possible to measure the high-temperature phase containing 15–35% Al, though the existence of this does not appear to be in doubt. H. E. B.

Bradley (A. J.). *The crystal structure of Cu_9Al_4.* (*δ copper-aluminium.*) Phil. Mag., 1928, ser. 7, vol. 6, pp. 878–888, 1 pl.

The Cu–Al δ-phase of Stockdale only actually extends between 16 and 19% Al. The crystal-structure is on the lines of the cubic space-group T_d^1. There are 52 atoms in the unit cell, 36 Cu and 16 Al. The former consist of 22 atoms of one sort and 14 of another, while the aluminiums also are of two sorts, 12 and 4 of each. The structure is closely related to the Cu–Zn alloy with 61–69% Zn, and

may be described as of the CsCl type, the cube corners being grouped with $Cu_{22}Al_4$ and the cube centres $Cu_{14}Al_{12}$. H. E. B.

Mehl (Robert Franklin). *The crystal structure of the system cadmium-mercury.* Journ. Amer. Chem. Soc., 1928, vol. 50, pp. 381–390, 3 figs.

An investigation of the system Cd–Hg is conducted by the powder method. Different parts of the ω field of the equilibrium diagram give the same spectral lines and indicate that the cell dimensions for the varying compositions remain the same. The 60·1% Cd alloy comes in the heterogeneous field α and ω, but shows only the lattice of the α solid solution, the latter being practically identical with that of pure cadmium as described by Hull. The close relationship between the centred-tetragonal lattices of the solutions with higher percentages of mercury and the hexagonal lattice of pure cadmium is shown. The author considers it highly probable that pure mercury has the same structure (centred-tetragonal) as the solid solutions rich in mercury. H. E. B.

Friauf (James B.). *The crystal structures of two intermetallic compounds.* Journ. Amer. Chem. Soc., 1927, vol. 49, pp. 3107–3114.

The compound Cu_2Mg has a cubic structure based upon O_h^7 with a unit cell length of 6·99 Å. The parameters, as found, show that the atoms occupy similar positions to those of Mg and Al_2 atoms in the structure of spinel and to those of K_2, Zn, &c. in the complex cyanides of the type $K_2R''(CN)_4$. The unit cell of $CuAl_2$ is tetragonal with $a = 6{\cdot}04$ and $c = 4{\cdot}86$ Å. The atomic arrangement (D_{4h}^{19}) is in agreement with the results obtained by Jette, Phragmén, and Westgren. H. E. B.

Bradley (A. J.) & Gregory (C. H.). *The structure of some ternary alloys of copper, zinc and aluminium.* Mem. Manchester Lit. Phil. Soc., 1928, vol. 72 (for 1927–28), pp. 91–100.

The terms ' solid solution ', ' intermetallic compound ', &c. are discussed with reference to certain alloys of Cu–Al, Cu–Zn, and Cu–Al–Zn. The crystal-structures of five alloy-phases of the three metals are worked out, the unit cells varying from 8·69 to 8·85 Å. and containing in each case 52 atoms. The ratio C_E/C_A, i.e. the concentration of valency electrons divided by the number of atoms present, is found to be constant throughout the range. H. E. B.

Oftedal (Ivar). *Über einige Kristallstrukturen vom Typus NiAs.* Zeits. Physikal. Chem., 1927, vol. 128, pp. 135–153.

Precision measurements by the powder method on various intermetallic compounds show that they possess the NiAs type of structure. The unit cell contains two molecules, and the cell-edges, calculated densities, and interatomic distances are listed below :—

RX.	*c.*	*a.*	*c/a.*	Calculated density.	Interatomic distance R–X.
FeSe ...	5·87 Å.	3·61 Å.	1·62	—	2·55 Å.
CoSe ...	5·278	3·614	1·460	7·80	2·470
NiSe ...	5·33	3·66	1·46	—	2·50
CrTe ...	6·211	3·981	1·560	7·00	2·774
MnTe ...	6·698	4·124	1·624	6·14	2·912
CoTe ...	5·360	3·886	1·380	8·80	2·615
NiTe ...	5·354	3·957	1·353	8·50	2·649
CrSb ...	5·468	4·107	1·331	7·16	2·738
Mn_1Sb_1 ...	5·784	4·120	1·404	6·90	2·785
Mn_3Sb_2 ...	5·744	4·131	1·390	6·33	2·785
Fe_1Sb_1 ...	5·130	4·064	1·262	8·00	2·673
Fe_3Sb_2 ...	5·168	4·123	1·253	7·11	2·708
CoSb ...	5·188	3·866	1·342	8·85	2·582
NiSb ...	5·133	3·907	1·314	8·70	2·595

F. A. B.

Oftedal (Ivar). *Röntgenographische Untersuchungen von Manganarsenid, Eisentellurid, Nickelstannid und Platinstannid.* Zeits. Physikal. Chem., 1928, vol. 132, pp. 208–216.

The dimensions of the unit hexagonal cells of these four compounds were found by the powder method.

	c.	*a.*	*c/a.*
MnAs	5·704 Å.	3·716 Å.	1·535
FeTe	5·651	3·800	1·487
NiSn	5·174	4·081	1·268
PtSn	5·428	4·103	1·323

Manganese arsenide and platinum stannide possess the NiAs structure, and probably the other two compounds also have the same structure. (See preceding abstract.) F. A. B.

Oftedal (Ivar). *Die Gitterkonstanten von CaO, CaS, CaSe, CaTe.* Zeits. Physikal. Chem., 1927, vol. 128, pp. 154–158.

Precision measurements by the powder method yield the following cell-edges: CaO, $a = 4{\cdot}802$; CaS, $a = 5{\cdot}686$; CaSe, $a = 5{\cdot}912$; and CaTe, $a = 6{\cdot}345$ Å. The values obtained by other investigators are quoted. It is shown that CaTe also belongs to the rock-salt type of structure. F. A. B.

Machatschki (Felix). *Algodonit und whitneyit.* Neues Jahrb. Min., Abt. A, 1929, vol. 59, pp. 137–158.

Specimens from Michigan of these two copper-arsenic minerals were investigated by the X-ray powder method and microscopically on polished sections. The whitneyite contained Cu 87·78% and had sp. gr. 8·45. Both minerals are mixtures of: (1) a cubic substance which appears to be metallic copper contaminated with a small amount of arsenic, and (2) a compound poorer in copper than Cu_6As and possessing the hexagonal type of close-packed structure. Whitneyite contains about 60% of the cubic component, and algodonite about 80% of the hexagonal component. The lattice constants are: a = 3·647–3·651 Å. for the cubic component, and a = 2·598–2·599, c = 4·213–4·215 Å. for the hexagonal component. The calculated density for the latter is 8·71–8·72. [Cf. M.A. **1**–258.] F. A. B.

Zachariasen (William). *The crystal structure of $MoSi_2$ and WSi_2.* Norsk Geol. Tidsskr., 1927, vol. 9 (for 1926–7), pp. 337–342, 1 fig.

——. *Über die Kristallstruktur von $MoSi_2$ und WSi_2.* Zeits. Physikal. Chem., 1927, vol. 128, pp. 39–48, 4 figs.

Powder photographs of these two compounds show that they crystallize in the holohedral class of the tetragonal system. The unit cell is body-centred and contains two molecules; the cell dimensions are a = 3·200, c = 7·861 Å. for $MoSi_2$, and a = 3·212, c = 7·880 Å. for WSi_2. The space-group is D_{4h}^{17} and the positions of the atoms are given. This is a new type of structure in which a Mo or W atom is surrounded by ten Si atoms and every Si atom by five Mo or W atoms and five Si atoms. The calculated densities are 6·24 and 9·75. F. A. B.

Zachariasen (William). *Über die Kristallstrukturen der Selenide von Beryllium, Zink, Cadmium und Quecksilber. Mit Präzisionsbestimmungen der Gitterkonstanten.* Zeits. Physikal. Chem., 1926, vol. 124, pp. 436–448.

The author shows how to calculate the probable limits of error for the determination of the cell dimensions of a crystal lattice, and applies his method to the selenides of Be, Zn, Cd, and Hg. In agreement with crystallographic data ZnSe and HgSe are found to possess a cubic structure, whereas CdSe is hexagonal. BeSe, not previously described, is also found to be cubic. Powder photographs of these four selenides prepared artificially yield the following data:

Be, Zn, and Hg selenides have the blende structure, and the unit cells, containing in each case four molecules, are found to have the edge dimensions 5·129, 5·661, and 6·068 Å. respectively. CdSe crystallizes with the wurtzite structure and its unit cell, containing two molecules, has the dimensions $a = 4·30$, $c = 7·01$ Å. The calculated densities are 4·315, 5·261, 8·266, and 5·63 respectively. F. A. B.

Zachariasen (William). *Über die Kristallstruktur des Magnesiumtellurids.* Zeits. Physikal. Chem., 1927, vol. 128, pp. 417–420.

Powder photographs of magnesium telluride show that the structure is of the wurtzite type. The unit hexagonal cell contains two molecules: $a = 4·52$, $c = 7·33$ Å. The calculated density is 3·86. The parameter u is approximately 0·375, and thence the atomic distance Mg–Te = 2·76 Å. Ionic radii calculated from lattices of the rock-salt type give Mg–Te = 2·89 Å. F. A. B.

Goldschmidt (V. M.). *Die Gitterkonstante des Bariumtellurides.* Zeits. Krist., 1929, vol. 69, pp. 411–414.

The value of the lattice-constant of the rock-salt structure of barium telluride was found by V. M. Goldschmidt [M.A. **3**–326] to be 6·986 Å., and by M. Haase [M.A. **3**–421], using two different methods, to be 6·82 and 6·86 Å. The observations were repeated on three preparations of BaTe with the result that Goldschmidt's value is confirmed. H. H.

Aminoff (G.) & Parsons (A. L.). *The crystal structure of sperrylite.* Univ. Toronto Studies, Geol. Ser., 1928, no. 27, pp. 5–10, 1 pl.

Sperrylite from Sudbury, Ontario, gave by the powder method $a = 6·00$ Å. (by the rotating crystal method a less accurate result $a = 5·90$ Å.) with four molecules $PtAs_2$ in the unit cell. The space-group is T_h^6 and the structure is the same as that of pyrite. A powder photogram of pyrite gave $a = 5·40$ Å. L. J. S.

Hendricks (Stirling B.) & Dickinson (Roscoe G.). *The crystal structures of ammonium, potassium and rubidium cupric chloride dihydrates.* Journ. Amer. Chem. Soc., 1927, vol. 49, pp. 2149–2162, 1 fig.

These crystals are tetragonal and are assumed, in default of evidence to the contrary, to belong to the ditetragonal-bipyramidal (equatorial) class of this system. The axes of the unit cell, as obtained by X-ray investigation, are inclined at 45° to the hitherto accepted crystallographic axes. There are two molecules of

$K_2CuCl_4.2H_2O$ in this cell and the rubidium and ammonium salts are similar. By the customary methods of elimination, space-groups C_{4v}^4 and D_{4h}^{14} are arrived at and an arrangement on the latter has been found which satisfies all observations. The parameters for the various atoms are given and the structure indicates that two sorts of chlorine atoms are probably present. H. E. B.

Hendricks (Sterling B.) & Merwin (Herbert E.). *The atomic arrangement in crystals of the alkali platini-thiocyanates.* Amer. Journ. Sci., 1928, ser. 5, vol. 15, pp. 487–494, 3 figs.

Ruby-red six-sided plates of the anhydrous salts were crystallized from alcohol. Laue and oscillation photographs gave the following data. The positions of the atoms are given for the space-groups 3Di–1 and 3Di–3.

	a.	*c.*	*c/a.*	Sp. gr.
$(NH_4)_2Pt(SCN)_6$ ...	6·77 Å.	10·45 Å.	1·32	2·35
$K_2Pt(SCN)_6$ ...	6·73	10·26	1·35	2·49
$Rb_2Pt(SCN)_6$ ...	6·75	10·47	—	2·79

The axial ratios given above are those from goniometric measurements. For the potassium salt ω 1·89, ϵ 1·82(Na); the dispersion is also given. L. J. S.

Zachariasen (William). *Über die Kristallstruktur des Quecksilberoxyds.* Zeits. Physikal. Chem., 1927, vol. 128, pp. 421–429, 3 figs.

Artificial mercuric oxide is shown by powder photographs to crystallize in the orthorhombic system. The unit cell contains two molecules of HgO and its dimensions are $a = 3{\cdot}296$, $b = 3{\cdot}513$, $c = 5{\cdot}504$ Å. The calculated density is 11·22. The mercury atoms form a body-centred lattice, and two possible configurations are deduced for the oxygen atoms. Levi's results [M.A. **2**–512] on the crystallographic identity of the red and yellow HgO are confirmed. F. A. B.

Zachariasen (William). *Über die Kristallstruktur des Palladiumoxyds (PdO).* Zeits. Physikal. Chem., 1927, vol. 128, pp. 412–416.

Powder photographs of palladium oxide prepared by two different methods give a tetragonal cell containing two molecules of PdO, $a = 3{\cdot}029$, $c = 5{\cdot}314$ Å. These dimensions are greater than those obtained by Levi and Fontana (1926). The calculated density is 8·31. The palladium atoms form a body-centred lattice, but accurate intensity measurements would be necessary to assign parameters to the oxygen atoms. Palladium oxide is probably isomorphous with SnO and red PbO. F. A. B.

Sturdivant (J. H.) & Pauling (Linus). *Note on the paper of A. Schröder: Beiträge zur Kenntnis des Feinbaues des Brookits usw.* Zeits. Krist., 1929, vol. 69, pp. 557–559, 2 figs.

The authors assigned the space-group V_h^{15} to brookite in a recent paper [M.A. **4**–28]. Observations by A. Schröder [M.A. **4**–29] are inconsistent with this group; and the authors show that the discrepancy is due to an error of Schröder in assigning indices to lines on rotation photographs. H. H.

Topping (J.). *On the form and potential energy of the isomorphous crystals, ruby (Al_2O_3) and hæmatite (Fe_2O_3).* Proc. Roy. Soc. London, Ser. A, 1929, vol. 122, pp. 251–273, 4 figs.

From expressions for the electrostatic forces and the intrinsic repulsive forces between the ions, regarded as point-charges, the total potential energy of ruby and haematite crystals can be calculated. The structure parameters of these substances, previously determined by X-ray methods [M.A. **2**–510], can then be satisfactorily explained, provided that a smaller value of the intrinsic repulsive force-constant for O^{--} ions is used than that determined by Lennard-Jones and Dent (Proc. Roy. Soc. London, Ser. A, 1926, vol. 112, p. 230). Reasons are also indicated for the observed distortion from an exact hexagonal close-packed system of the oxygen ions in ruby and haematite. F. A. B.

Pauling (Linus). *The crystal structure of the A-modification of the rare earth sesquioxides.* Zeits. Krist., 1929, vol. 69, pp. 415–421, 2 figs.

A structure with space-group D_{3d}^3 is suggested for La_2O_3, Ce_2O_3, Pr_2O_3, Nd_2O_3 based on W. Zachariasen's [M.A. **3**–181] unit cell containing one molecule and having a and c respectively 3·93 and 6·12, 3·88 and 6·06, 3·85 and 6·00, 3·84 and 6·01 Å. for the four substances, which is in better agreement with existing knowledge of interionic distances and the structure of other oxides. H. H.

Zachariasen (William). *The crystal structure of the modification C of the sesquioxides of the rare earth metals, and of indium and thallium.* Norsk Geol. Tidsskr., 1927, vol. 9 (for 1926–7), pp. 310–316, 2 figs.

Crystallographic, optical, and X–ray data show that this series of isomorphous oxides possess cubic symmetry. The unit cell contains

sixteen molecules R_2O_3, and is body-centred. Laue photographs of Tl_2O_3 exhibit hemihedral symmetry and the space-group is found to be T^5. The observed intensities of powder photographs lead to values for the parameters of the metal atoms, whilst by assuming that the oxygen atom is the same distance from the surrounding metal atoms the author calculates the parameters for the oxygen atoms. The length of the cell-edge is given for each oxide [M.A. **3**–181]. F. A. B.

Posnjak (E.). *The lattice dimensions of spinel* ($MgAl_2O_4$). Amer. Journ. Sci., 1928, ser. 5, vol. 16, pp. 528–530.

Powder photographs of artificial spinel (n 1·717) give 8·03 Å. as the edge of the unit cube containing eight molecules of $MgAl_2O_4$. The calculated density is 3·628. L. J. S.

Brentano (J.) & Adamson (J.). *Precision measurements of X-ray reflexions from crystal powders. The lattice constants of zinc carbonate, manganese carbonate, and cadmium oxide.* Phil. Mag., 1929, ser. 7, vol. 7, pp. 507–517.

Precision measurements by the powder method yield $d_{100} = 5{\cdot}493$ Å. for zinc carbonate and $d_{100} = 5{\cdot}666$ Å. for manganese carbonate. The corresponding lengths of the sides of the elementary cleavage rhombs are $a = 5{\cdot}928$ and 6·064 Å., and the calculated densities are 4·406 and 3·747 respectively. These redetermined values agree more closely with the calculated lattice constants for the carbonate series. Cadmium oxide was used as a standardizing substance in this work owing to its large volume absorption. Its redetermined cell-edge is $a = 4{\cdot}683$ Å. F. A. B.

Nagy (L. József). *A gipszkristályok rácsállandójára vonatkozó vizsgálatok. —Untersuchungen über die Raumgitterkonstanten der Gipskristalle.* Mat. Természettud. Értesítő, Budapest, 1928, vol. 45, pp. 609–616, 1 fig., German summary, pp. 617–618.

Nagy (Joseph). *Untersuchungen über die Atomebenenabstände der Gipskristalle.* Zeits. Physik, 1928, vol. 51, pp. 410–412, 1 fig.

By measuring accurately the separation between the first and second order X-ray reflections Cu Kα from the cleavage face of gypsum it was possible to compare a large number of crystals of gypsum from various localities. The maximum variation in atomic spacing is 2·5%. F. A. B.

Goßner (B.) & Brückl (K.). *Die Gitterkonstanten von Kupfervitriol.* Zeits. Krist., 1929, vol. 69, pp. 422–426.

Copper sulphate has a unit cell containing two molecules $CuSO_4.5H_2O$ whose edges and angles are given by $a = 6{\cdot}07$, $b = 10{\cdot}78$, $c = 5{\cdot}89$ Å.; $\alpha = 82° 5'$, $\beta = 107° 8'$, $\gamma = 102° 41'$. H. H.

Goßner (B.) & Mußgnug (F.). *Über strukturelle Beziehungen bei Alkalisulfaten.* Zeits. Krist., 1929, vol. 69, pp. 446–454.

Sodium sulphate has the space-group V^2_h; and the unit cell contains eight molecules of Na_2SO_4 having edges $a = 9{\cdot}79$, $b = 5{\cdot}89$, $c = 12{\cdot}31$ Å. Its structure is compared with that of K_2SO_4, $KLiSO_4$, and $K_3Na(SO_4)_2$. H. H.

Ogg (A.). *The crystal structure of the isomorphous sulphates of potassium, ammonium, rubidium, and cæsium.* Phil. Mag., 1928, ser. 7, vol. 5, pp. 354–367, 2 pls., 4 text-figs.

The author completes the work, originally taken in hand by himself and Hopwood some years ago [M.A. **2**–103], on the structures of the salts in this series. The space-group is found to be V^{16}_h and the positions of all the atoms are worked out. There is an explanation of the formation of triplets of K_2SO_4, &c., based upon the ascertained structure. Dimensions and parameters are all given. H. E. B.

Taylor (William) & Boyer (T.). *An investigation into the structure of caesium and ammonium sulphates.* Mem. Manchester Lit. Phil. Soc., 1928, vol. 72 (for 1927–28), pp. 125–137, 2 figs.

These structures, independently arrived at, substantiate the results obtained by A. Ogg (preceding abstr.). The unit cells, based upon V^{16}_h, contain four molecules with the following dimensions:

Cs_2SO_4, $a = 6{\cdot}24$, $b = 10{\cdot}92$, $c = 8{\cdot}22$; $(NH_4)_2SO_4$, $a = 5{\cdot}98$, $b = 10{\cdot}62$, $c = 7{\cdot}78$ Å. H. E. B.

Vegard (L.) & Maurstad (Alf). *Die Kristallstruktur der wasserfreien Alaune $R'R''(SO_4)_2$* [sic]. Zeits. Krist., 1929, vol. 69, pp. 519–532, 1 pl., 5 figs.

The four anhydrous alums $KAl(SO_4)_2$, $KCr(SO_4)_2$, $NH_4Al(SO_4)_2$, $NH_4Fe(SO_4)_2$ have a hexagonal unit cell containing a molecule apiece. The quantities a and c for the four substances are respectively 4·706 and 7·960, 4·737 and 8·030, 4·724 and 8·225, 4·825 and 8·310 Å. The space-group is D^2_3. H. H.

Gottfried (C.). *Über die Struktur der Phenakit-Dioptasgruppe.* Neues Jahrb. Min., Abt. A, 1927, vol. 55, pp. 393–400, 1 pl.

The following constants were obtained by the rotating crystal method. Analyses of the troostite showed MnO 4·88%. In each case the unit trigonal cell contains 18 molecules (36 in the ortho-hexagonal cell) and the space-group is C_{3i}^{2}. A difference in the intensity of the layer-lines for dioptase is no doubt due to the hydrogen atoms. [Cf. M.A. **3**–343–4, **3**–432.]

	a.	*c*.
Phenakite, Be_2SiO_4	12·49 Å.	8·26 Å.
Willemite, Zn_2SiO_4	14·14	9·58
Troostite, $(Zn,Mn)_2SiO_4$	14·21	9·62
Dioptase, CuH_2SiO_4	14·66	7·83

L. J. S.

Goßner (B.) & Mußgnug (F.). *Über die systematische Stellung von Neptunit und Babingtonit.* Centr. Min., Abt. A, 1928, pp. 274–281.

Neptunite from California gave by the rotating crystal method $a = 16·54$, $b = 12·64$, $c = 10·04$ Å. $[a : b : c = 1·308 : 1 : 0·794]$, $\beta = 64° 22'$, with eight molecules $Si_2O_6FeNa_2.Si_2TiO_6$ in the unit cell. The space-group is C_{2h}^{3} or C_{2h}^{6}. The relation to aegirine previously suggested [M.A. **2**–423] is fictitious. Babingtonite from Arendal gave $a = 7·54$, $b = 12·43$, $c = 6·73$ Å. $(a : b : c = 0·607 : 1 : 0·541)$, $\alpha = 93° 48'$, $\beta = 86° 9'$, $\gamma = 112° 22'$, with four molecules $Si_2O_6CaFe.SiO_2$ in the unit cell. This formula shows a pyroxene metasilicate with the addition of SiO_2 and the replacement of SiFe by Al_2. A suggested relation to anorthite is not satisfied. L. J. S.

Goßner (B.) & Brückl (K.). *Über strukturelle Beziehungen von Rhodonit zu anderen Silikaten.* Centr. Min., Abt. A, 1928, pp. 316–322.

Rhodonite (sp. gr. 3·645) from Franklin Furnace gave by the rotating crystal method $a = 7·77$, $b = 12·45$, $c = 6·74$ Å. $(a : b : c = 0·624 : 1 : 0·541)$, $\alpha = 85° 10'$, $\beta = 94° 4'$, $\gamma = 111° 29'$, with two molecules $SiO_3Mn.Si_4O_{12}Mn_3Ca$ in the unit cell. The parameter $b = 12·45$ of the cleavage zone does not compare with that of diopside ($c = 5·24$ Å.). Comparisons are made with babingtonite and anorthite. L. J. S.

Goßner (B.) & Mußgnug (F.). *Über den Ägnigmatit und seine Stellung im System der Silikate.* Centr. Min., Abt. A, 1929, pp. 5–11.

Aenigmatite from Greenland gave by the X-ray rotating crystal method the lattice constants $a = 20·3$, $b = 29·7$, $c = 10·6$ Å. (corre-

sponding with $a : b : c = 0{\cdot}68 : 1 : 0{\cdot}36$), which do not agree with those of ordinary hornblende, viz. $a = 9{\cdot}94$, $b = 18{\cdot}38$, $c = 5{\cdot}36$ Å. Taking, however, another orientation for the crystals, (110) as (010), $(1\bar{1}0)$ as (100), and (001) as before, the pseudo-hexagonal character is brought out more strongly, and the lattice constants are then $a = 18{\cdot}3$, $b = 18{\cdot}3$, $c = 10{\cdot}6$ Å. ($a : b : c = 1{\cdot}00 : 1 : 0{\cdot}58$), $\alpha = 96° 38'$, $\beta = 96° 35'$, $\gamma = 113° 21'$. When a and c are halved a relation is shown with hornblende, but it seems that aenigmatite does not strictly belong to the hornblende group. Similarly, babingtonite and rhodonite show a want of structural relation to the pyroxene group. L. J. S.

Gossner (B.) & Mussgnug (F.). *Die Gitterkonstanten von Epididymit.* Festschrift Victor Goldschmidt, Heidelberg, 1928, pp. 117–126.

Rotating spectrograms gave a unit cell $a = 7{\cdot}33$, $b = 12{\cdot}73$, $c = 13{\cdot}60$ Å. ($a : b : c = 0{\cdot}576 : 1 : 1{\cdot}068$, i. e. c twice the length taken by G. Flink) containing eight molecules $Si_2O_5Be.SiO_5NaH$. The space-group is V_h^1, and positions are suggested for the atoms, but there are too many unknown parameters. L. J. S.

Goßner (B.). *Über strukturelle Beziehungen zwischen Beryll und Cordierit.* Centr. Min., Abt. A, 1928, pp. 204–207.

A preliminary note. [See following abstract.]

Goßner (B.) & Mußgnug (F.). *Vergleichende röntgenographische Untersuchung von Magnesiumsilikaten.* Neues Jahrb. Min., Abt. A, 1928, vol. 58, pp. 213–252.

The following silicates were examined by the rotating crystal method with the idea of readjusting the chemical formulae so that whole numbers of molecules shall be contained in the unit cell. Cordierite has a unit cell of dimensions $a = 17{\cdot}10$, $b = 9{\cdot}78$, $c = 9{\cdot}33$ Å., and containing four molecules $Si_5O_{12}Mg_2.2Al_2O_3$. The space-group is V_h^{17}. The positions of the atoms are compared for cordierite and beryl, it being supposed that $SiBeBe_2$ and Al_2Mg_2 are replaceable. Prismatine from Waldheim, Saxony, gave on analysis SiO_2 33·20, Al_2O_3 42·36, Fe_2O_3 0·30, FeO 5·81, MgO 11·76, Na_2O 5·07, K_2O 0·83, H_2O 1·60 = '100·97'; sp. gr. 3·280. The unit cell, $a = 13{\cdot}86$, $b = 16{\cdot}02$, $c = 6{\cdot}78$ Å., contains four molecules $3Al_2O_3.4SiO_3Mg$ in which SiO_3Mg is partly replaced by SiO_3NaH. The space-group is one of V_h^{17}–V_h^{22}. Kornerupine from Fiskernäs, Greenland, gave $c = 6{\cdot}8$ Å., agreeing with prismatine. Sapphirine from Fiskernäs gave $a = 9{\cdot}70$, $b = 14{\cdot}55$, $c = 10{\cdot}05$ Å. ($a : b : c = 0{\cdot}667 : 1 : 0{\cdot}691$), $\beta = 74° 31'$, with eight molecules $SiO_4Mg_2.2Al_2O_3$ with replacement of SiMg by Al_2. Black basaltic hornblende from Gross-

priesen, Bohemia, gave $a = 9{\cdot}94$, $b = 18{\cdot}38$, $c = 5{\cdot}36$ Å. ($a : b : c = 0{\cdot}541 : 1 : 0{\cdot}292$), $\beta = 74° 15'$, containing four molecules $3SiO_3Mg.SiO_3Ca$, with the replacements $SiMg = (Al,Fe)_2$, $MgCa = AlNa$, $Si = Ti$, &c. The space-group is C_{2h}^3 or C_{2h}^6. Actinolite from Zillerthal, Tyrol, gave $a = 9{\cdot}91$, $b = 18{\cdot}5$, $c = 5{\cdot}36$ Å. ($a : b : c = 0{\cdot}536 : 1 : 0{\cdot}290$), $\beta = 74° 24'$, with four molecules of the type $3SiO_3Mg.SiO_3Ca$, with replacements $SiMg = Al_2$, $Ca = NaH = H_2$, $Mg = H_2$. Glaucophane from Zermatt gave $a = 9{\cdot}72$, $b = 17{\cdot}89$, $c = 5{\cdot}37$ Å. ($a : b : c = 0{\cdot}543 : 1 : 0{\cdot}300$), $\beta = 75° 50'$, with four molecules $2SiO_3Mg.Si_2O_6AlNa$ [cf. M.A. **2**–422]. L. J. S.

Goßner (B.). *Über strukturelle Beziehungen zwischen Pyroxen und Amphibol.* Centr. Min., Abt. A, 1928, pp. 340–341.

Halving the edge b (9·19) the dimensions of the unit cell for black hornblende as given in the preceding abstract compare closely with those for diopside, $a = 9{\cdot}71$, $b = 8{\cdot}89$, $c = 5{\cdot}24$, $\beta = 74° 10'$, as determined by Wyckoff [M.A. **2**–505]. L. J. S.

Goßner (B.) & Mußgnug (F.). *Vergleichende röntgenographische Untersuchung von Kalknatronsilikaten.* Centr. Min., Abt. A, 1928, pp. 129–138, 167–181.

The following data were determined by the rotating crystal method. Gehlenite from Monzoni, the unit cell containing four molecules $SiO_4Ca_2.Al_2O_3$. Melilite ('humboldtilite'), from Monte Somma, with four molecules $CaO.Si_2O_6CaMg$. Sarcolite, from Vesuvius, with six molecules $Si_3O_8AlNa.Si_2O_8Al_2Ca.3CaO$.

	Sp. gr.	a.	c.	$a : c$.
Gehlenite ...	3·02	11·11 Å.	5·06 Å.	1 : 0·455
Melilite... ...	2·916	11·12	5·09	1 : 0·458
Sarcolite ...	2·917	17·6	15·59	1 : 0·886
Scapolite ...	—	17·25	7·65	1 : 0·443

Gehlenite and melilite are thus closely related, and their composition is expressed as mixtures of the molecules $CaO.SiO_3Ca.Al_2O_3$ (velardeñite), $CaO.SiO_3Ca.SiO_3Mg$ (åkermanite), and $CaO.SiO_3NaSiO_3Al$, in which there may further be replacements $Al_2 = SiMg$ [i. e. Al_2O_3 for $MgSiO_3$], $CaMg = NaAl$, and $SiNa = AlCa$ [cf. M.A. **2**–14]. On the other hand, sarcolite is more closely related to scapolite [following abstract], with probably the same space-group C_{4h}^5, and its composition may be expressed as an addition-compound of scapolite ($3Si_2O_8Al_2Ca.CaO$) with $3\frac{1}{2}$ CaO. The space-group of gehlenite and melilite is D_{4h}^3, and positions are assigned for the atoms. L. J. S.

Goßner (B.) & Brückl (K.). *Untersuchungen über die Skapolithgruppe.* Neues Jahrb. Min., Abt. A, 1928, vol. 58, pp. 349–384, 3 pls.

Analyses of carefully selected scapolite from nine localities are given, with densities and in some cases refractive indices. The mineral is formulated as 3 plagioclase + 1 salt, the plagioclase including albite, anorthite, and probably carnegieite, while the salt consists of varying proportions of calcium carbonate, sulphate, oxide, and chloride, and possibly 2NaCl may replace $CaCl_2$ to some extent. An X-ray study of material from Grass Lake, N.Y., gave the space-group as C_{4h}^{2} or C_{4h}^{4}, with $c = 7{\cdot}65$, and $a = 12{\cdot}21$ or $17{\cdot}25$ Å. respectively; the former unit cell contains two, the latter four, molecules of scapolite of the above formula. M. H. H.

Goßner (B.) & Mußgnug (F.). *Beitrag zur Kenntnis des Thortveitites.* Centr. Min., Abt. A, 1929, pp. 1–5, 1 fig.

X-ray photographs of a rotating crystal indicate a unit cell $a = 6{\cdot}56$, $b = 8{\cdot}58$, $c = 4{\cdot}74$ Å., $\beta = 76°\ 52'$ ($a : b : c = 0{\cdot}767 : 1 : 0{\cdot}552$), containing two molecules $Sc_2O_3.2SiO_2$. The space-group is C_{2h}^{3}. The layer-lines are not well developed, but a grouping of the atoms in the cell is suggested. L. J. S.

Cardoso (Gabriel Martin). *Über die Raumgruppe des Stauroliths und seine gesetzmäßige Verwachsung mit Cyanit.* Ber. Math.-Physis. Kl. Sächs. Akad. Wiss. Leipzig, 1928, vol. 80, pp. 165–199, 3 pls., 12 text-figs.

Schiebold (E.) & Cardoso (G. Martin). *Über die gesetzmäßige Verwachsung von Staurolith mit Cyanit und ihre Begründung durch die Kristallstruktur beider Mineralien.* Fortschr. Min. Krist. Petr., 1929, vol. 13, pp. 61–62.

Further examination of staurolite from Mte. Campione, Switzerland, gave the space-group as V_h^{17} [cf. M.A. **3**–434]. Further details are given on the regular intergrowth of staurolite and kyanite [M.A. **3**–529]. L. J. S.

Menzer (G.). *Die Kristallstruktur der Granate.* Zeits. Krist., 1928, vol. 69, pp. 300–396, 6 figs. [cf. M.A. **3**–251].

The six garnets $Ca_3Al_2Si_3O_{12}$, $Ca_3Fe_2Si_3O_{12}$, $Ca_3Cr_2Si_3O_{12}$, $Fe_3Al_2Si_3O_{12}$, $Mn_3Al_2Si_3O_{12}$, $Mg_3Al_2Si_3O_{12}$ have a structure with the space-group O_h^{10}. Their lattice-constants are respectively 11·840, 12·026, 11·950, 11·497, 11·603, 11·510 Å., and their calculated densities 3·605, 3·871, 3·858, 4·235, 4·197, 3·732. H. H.

Lonsdale (Kathleen) [*née* Yardley]. *Evidence of the anisotropy of the carbon atom.* Phil. Mag., 1928, ser. 7, vol. 6, pp. 433–446, 5 figs.

By considering the X-ray results on crystals of C_2Cl_6, pentaerythritol, and other compounds, a model of the carbon atom is obtained having two geometrically different valencies. It is considered that no satisfactory case has yet been made for the pyramidal atom, whilst the author's model can explain the symmetries of other simple carbon compounds. F. A. B.

Lonsdale (Kathleen) [*née* Yardley]. *The structure of the benzene ring in* $C_6(CH_3)_6$. Proc. Roy. Soc. London, Ser. A, 1929, vol. 123, pp. 494–515, 14 figs.

Hexamethylbenzene crystallizes as flat prisms bounded by three pinakoids. The melting-point is 164° C. and the density 1·042 at 18·5° C. No crystallographic data exist for this compound; measurements with the ionization spectrometer yield the following: $a = 9{\cdot}010$, $b = 8{\cdot}926$, $c = 5{\cdot}344$ Å., $\alpha = 44°\ 27'$, $\beta = 116°\ 43'$, $\gamma = 119°\ 34'$. The unit cell contains one molecule, $C_6(CH_3)_6$, which is probably centro-symmetrical, and the calculated density is 1·035. It is shown that the carbon atoms must all lie very nearly in the cleavage plane (001), and that the benzene ring is similar in size and shape to the flat six-carbon ring in graphite [M.A. **2**–507]. F. A. B.

Melle (F. A. van) & Schurink (H. B. J.). *Über die Kristallstruktur von Pentaerythrit, Pentaerythrit-Tetracetat und Dibenzalpentaerythrit.* Zeits. Krist., 1928, vol. 69, pp. 1–16, 6 figs.

A further discussion on the structure of these three compounds and the information they give as to the symmetry of the carbon atom [M.A. **3**–347, 436, 532; **4**–36]. F. A. B.

Radioactivity.

Kirsch (Gerhard). *Was vermögen die radioaktiven Methoden der Altersbestimmung von Mineralien heute zu leisten?* Tschermaks Min. Petr. Mitt., 1924, vol. 36, pp. 147–156.

The reliability of the method of arriving at the age of minerals from the lead (radium-G)/uranium ratio is discussed. It is necessary to know the atomic weight of the lead present in order to distinguish between primary lead and radium-G; and further, it is found that in

specimens for which this has been determined the composition varies from piece to piece. New estimates, in millions of years, are: for bröggerite from Moss, Norway, 895; pitchblende from Jáchymov, Bohemia, 207; uraninite from Morogoro, East Africa, 605; pitchblende from Katanga, Belgian Congo, 550. From the published data for thorianite from Ceylon, the half time-period for thorium is calculated as $T = (1{\cdot}65 \pm 0{\cdot}05) \times 10^{10}$ years, and the age of the thorianite estimated at about 150 million years. The genetic relationship between uranium and thorium is discussed, and for thorium uranium is calculated $T = 63{\cdot}2 \times 10^6$ or $62{\cdot}6 \times 10^6$ years. L. J. S.

Ellsworth (H. V.). *Radioactive minerals as geological age indicators.* Amer. Journ. Sci., 1925, ser. 5, vol. 9, pp. 127–144.

A discussion of the uncertainties and difficulties presented by the method of calculating the age of minerals from the ratio of contained uranium and lead or thorium and lead. It is suggested that the oxygen liberated by this breaking down of UO_2 may produce an auto-oxidation of the remaining UO_2 to UO_3 in the mineral. L. J. S.

Cotton (Leo A.). *Age of certain radium-bearing rocks in Australia.* Amer. Journ. Sci., 1926, ser. 5, vol. 12, pp. 41–46.

Ages are calculated from the (U + Th)/Pb ratios shown by eight published analyses. They range from 620 million years for fergusonite from Cooglegong, W.A., to 1,475 million years for mackintoshite from Wodgina, W.A. Less certain values are 240 for the secondary carnotite from Olary, S.A., and 3,840 for the altered pilbarite from Wodgina. The geological ages are early to late pre-Cambrian.

L. J. S.

Holmes (Arthur). *The age of the earth: an introduction to geological ideas.* London (Benn's Sixpenny Library, no. 102), 1927, 80 pp. Price 6*d.*

This popular booklet contains a good chapter on 'The radio-active timekeepers of the rocks'. From the average quantities of lead and radioactive elements in the rocks of the earth's crust the age of the earth is deduced as less than 3,000 million years, and from the oldest analysed radioactive minerals as greater than 1,400 million years.

L. J. S.

Piggot (Charles Snowden). *The radium content of Stone Mountain granite.* Journ. Washington Acad. Sci., 1928, vol. 18, pp. 313–316.

The radium content of a biotite-muscovite granite from Stone Mtn., Georgia, U.S.A., was determined by the emanation method, by

comparison with known amounts of radium salt which were added to the fusion. The values vary from 4·01 to $6·76 \times 10^{-12}$ gram of radium per gram of granite. A. F. H.

Piggot (Charles Snowden). *Radium in rocks: I. The radium content of some representative granites of the eastern seaboard of the United States.* Amer. Journ. Sci., 1929, ser. 5, vol. 17, pp. 13–34, 3 figs.

The rock is fused with alkali carbonates in a current of carbon dioxide, the radium and thorium emanations collected, and α-ray measurements made in a gold-leaf electroscope. The special apparatus is described in detail. Seven samples of granite were found to contain 0·378 to $4·826 \times 10^{-12}$ gram of radium per gram of rock. The radium appears to be contained in the heavier minerals and to be more on the surface of the grains : it can be partly leached out by hot water. L. J. S.

Piggot (Charles Snowden). *Lead isotopes and the problem of geologic time.* Journ. Washington Acad. Sci., 1928, vol. 18, pp. 269–273.

The amount of uranium lead in a given mineral may be estimated by conversion into a volatile compound such as lead tetramethyl, which is then examined by means of Aston's mass-spectrograph. Preliminary tests by F. W. Aston proved satisfactory and further work is in progress. A. F. H.

Fenner (Clarence N.). *Radioactive minerals from Divino de Ubá, Brazil.* Amer. Journ. Sci., 1928, ser. 5, vol. 16, pp. 382–391, 1 fig.

—— *The analytical determination of uranium, thorium, and lead as a basis for age-calculations.* Ibid., pp. 369–381.

Estimates of the uranium, thorium, and lead in carefully selected and purified materials from this locality [M.A. **3**–113] gave: for monazite, ThO_2 5·792, PbO 0·0999 %, also U_3O_8 0·06 % possibly as an impurity; for samarskite, U_3O_8 11·493, ThO_2 1·676, PbO 0·585 %. The age deduced in both cases is about 360 million years. The various uncertain factors are discussed, and the importance of separating decomposition products is emphasized. The second paper gives details of the methods of chemical analysis. L. J. S.

Schilling (A.). *Die radioaktiven Höfe im Flußspat von Wölsendorf.* Neues Jahrb. Min., Abt. A, 1926, vol. 53, pp. 241–265, 5 pls., 3 text-figs.

Several types of haloes in the dark-blue fluorite of Wölsendorf, Bavaria [M.A. **2**–359, **3**–117] are described and figured. Narrow

bands of colour also border crevices lined with uranotile. The radii of the several rings around a central nucleus is given (except for some unexplained cases) in I under the disintegration products of the uranium series to which each is attributed, and in II the equivalent ranges in air of the α-particles.

	UI.	UII.	Io.	Ra.	Po.	Em.	RaA.	RaC.
I.	14·0	14·4	15·8	16·9	19·3	20·5	23·5	34·5 μ.
II.	2·68	2·76	3·03	3·24	3·695	3·93	4·50	6·61 cm.

The colouring of the haloes is attributed to colloidal calcium ; it is discharged by heating at 250° C. in 22 hours, at 330° in 32 minutes, and at 450° in 40 seconds. L. J. S.

Kerr-Lawson (D. E.). *Pleochroic haloes in biotite from near Murray Bay, P. Q.* Univ. Toronto Studies, Geol. Ser., 1927, no. 24, pp. 54–70, 2 pls., 4 text-figs.

A brief introduction on pleochroic haloes in general is followed by a detailed description of those in a good cleaving biotite (yielding flakes 6 μ thick) from a pegmatite vein in pre-Cambrian granite in the province of Quebec. They are often arranged along definite cleavage planes and cracks (suggesting that they are of later introduction), and they show different stages in their development. Measurements of the outer radii of the series of rings gave 12·3, 15·4, 18·6, 22·0, and 33·0 μ. The effect on the darkened and bleached zones in overlapping haloes is described, and the intensities of the zones are plotted. From a detailed chemical analysis of this mica (sp. gr. 3·116) conversion factors are calculated and compared with the ionization distances of α-particles from RaC in air. The haloes are destroyed by heating at 425° C. for twenty-four hours or at 700° C. in five minutes. L. J. S.

Kerr-Lawson (D. E.). *Pleochroic haloes in biotite.* Univ. Toronto Studies, Geol. Ser., 1928, no. 27, pp. 15–27, 2 pls.

The haloes in the Murray Bay biotite have been further studied. Enlarged photographs of them were measured with a micro-photometer and the light absorption plotted against the distance from the centre. The dark rings are then shown as maxima on the curve. With very thin sections (less than $\frac{1}{10}$ the halo diameter) five rings (rather than four) are seen. The radii of these five rings are in approximately the same ratio as the ranges in air of α-particles from the uranium series, which fall into five groups, viz. : (1) uranium I, corresponding with the innermost ring ; (2) ionium, uranium II, and

radium, all very close together and giving rise to a single ring; (3) radium F and radon, also very close together; (4) radium A; (5) radium C, corresponding to the outermost ring. There is thus no evidence, as suggested by J. Joly, that uranium disintegrated faster in earlier geological times than it does now. A concentric distribution of the darkening effect between the rings is apparently due to a terminal reversal effect, by which, in the region of the end of the range of a given set of α-particles, the development of darkening due to other sets of α-particles is inhibited. L. J. S.

Poole (J. H. J.). *The action of heat on pleochroic halos.* Phil. Mag., 1928, ser. 7, vol. 5, pp. 132–141, 2 pls., 2 text-figs.

—— *Note on the formation of pleochroic halos.* Ibid., p. 444.

The pleochroic haloes in biotite disappear when the mica is heated to a dull red-heat. Photomicrographs taken at various temperatures show that this is not due to loss of colour in the haloes, but to the darkening of the whole of the mica at 610–700° C. Dehydration curves show that water is lost at this temperature, and the darkening of the mica is evidently due to loss of water. It is suggested that the darkening in the haloes themselves may also be due to the decomposition of the water contained in the mica by α-rays; with the further suggestion in the second note that the liberated oxygen changed the ferrous iron to ferric. L. J. S.

Turner (Henry W.). *Review of the radioactive minerals of Madagascar.* Econ. Geol., 1928, vol. 23, pp. 62–84, 2 figs.

The details given of the characters and occurrence of uranium and thorium minerals have been largely compiled from A. Lacroix's 'Minéralogie de Madagascar' [M.A. **2**–146]. The minerals are collected from pegmatites and the overlying laterite, and a few tons of betafite (UO_3 27 %) and euxenite (UO_2 16 %) have been exported. A secondary ore containing small scales of autunite and colloidal uranium phosphate in a peaty alluvium has also been exploited.

L. J. S.

Turner (Henry W.). *General geology of the Katanga radium deposits.* Mining Mag. London, 1926, vol. 34, pp. 220–223, 1 fig.

Notes on the work and map of P. Fourmarier. Pitchblende and its alteration products occur as bunches in veins of copper ore which traverse metamorphic schists and dolomite. It was first discovered

in the Luiswishi mine in 1913, and the more important deposits were found in the Chinkolobwe mine in 1915. L. J. S.

Radium sub-committee. Report. Committee of Civil Research. London (H.M. Stationery Office), 1929, 31 pp. Price 6*d*.

The requirements of radium for medical purposes and the sources of supply are considered. Occurrences of uranium minerals in the British Empire (Cornwall, Canada, Australia, India, South Africa, and Tanganyika Territory) and in Belgian Congo, United States, Czechoslovakia, Portugal, Russia, and Madagascar, are briefly mentioned. L. J. S.

Meteorites and Tektites.

Millosevich (F.). *Le meteoriti del Museo Mineralogico dell' Università di Roma.* Roma (G. Bardi), 1928, 38 pp.

This is an alphabetical list of 190 meteorite falls, giving weights of the individual specimens, represented in the collection of the Mineralogical Museum of the University of Rome. Fifteen Italian falls (all stones) are listed, and for these the specimens preserved in other Italian collections are noted. From Italian Somaliland there are the stones Bur-Gheluai (represented by 58 complete or nearly complete stones, the largest weighing 15·4 kg.) and Ergheo, and the iron Uegit (the complete mass of about 251 kg.). L. J. S.

Hoffer (András). *A kabai meteorit története.* [History of the Kaba meteorite.] Debreczeni Szemle [Debreczen Review], 1928, pp. 1–15, 1 fig.

A detailed historical account is given of the meteoric stone which fell on April 15, 1857, at Debreczen, co. Bihar, Hungary. The main mass, weighing 2686 grams and measuring $16\frac{1}{2} \times 10$ cm., is preserved in the Reform College at Debreczen. K. Z.

Wilson (Ben Hur). *The Estherville meteor.* The Palimpsest, Iowa, 1928, vol. 9, pp. 317–333, 1 pl., 3 text-figs.

An interesting popular account of the fall of the Estherville (Iowa) meteorite on May 10, 1879, and the subsequent history of some of the pieces. L. J. S.

Lacroix (A.). *Sur un aérolithe tombé à Beyrouth (Syrie), le 31 décembre 1921.* Compt. Rend. Acad. Sci. Paris, 1929, vol. 188, pp. 949–951.

A stone weighing about 1,100 grams fell at 15 h. 45 m. through the roof of a hut near the University of St. Joseph at Beyrout

(Beirut). Several detonations were heard and the stone was hot when picked up. The stone has since been lost and only small fragments have been preserved. It is classed as a 'miosidiferous chondrite' [M.A. **3**–534] with abundant clinohypersthene. The structure is tufaceous with chondrules of various types in a brecciated cement of olivine, hypersthene, and clinohypersthene, with little maskelynite, felspar, nickel-iron, and pyrrhotine. L. J. S.

Coulson (A. L.). *A new Indian meteorite: the Lua fall.* Rec. Geol. Survey India, 1928, vol. 61, pp. 318–324, 5 pls., 1 text-fig.

A shower of stones fell at about 4 p.m. on June 26, 1926. Two stones were picked up at Lua (24° 57′ N., 75° 9′ E.) in Udaipur State, one at Dongria in Udaipur State, and three fragments of a fourth at Dabra in Indore State; the three localities being about three miles apart at the corners of a triangle. The largest stone (found at Lua) weighs 8632 grams and the total weight of the four stones is about 9240 grams. The stone is a grey chondrite with olivine chondrules and crystals, fibrous enstatite, nickel-iron, and troilite. Specific gravity 3·534. L. J. S.

Palache (Charles) & Shannon (Earl V.). *A new meteorite from Washington County, Colorado.* Amer. Min., 1928, vol. 13, pp. 406–409, 1 pl.

A disk-shaped mass of iron weighing 5750 grams was found at a depth of 12 inches in a wheat-field in Washington County at lat. 39° 42′ N., long. 103° 10′ W. It shows no sign of rusting and is probably a recent fall, perhaps in 1916. One surface is slightly conical with imperfect radial flutings. The polished surface shows no structure and the iron is a moderately nickel-rich ataxite. Analysis of the planings gave: Fe 90·078, Ni 9·342, Co 0·548, Cu 0·010, P 0·298, S 0·003, Mn, Pt traces, insol. 0·004, total 100·283.

L. J. S.

Nininger (H. H.). *The Duchesne meteorite: an undescribed find from Duchesne County, Utah.* Journ. Geol. Chicago, 1929, vol. 37, pp. 83–87, 4 figs.

A 50 lb. mass of iron without history. Polished and etched surfaces show well-marked Widmänstatten figures and the iron is classed as a fine octahedrite. Analysis by F. G. Hawley gave: Fe 89·26, Ni 9·20, Co 0·41, Cu 0·08, Cr, Mg traces, P 0·21, S 0·01, SiO_2 0·15, C 0·07, O 0·44 = 99·83. Troilite is present as large

nodules, and is unusual in not being attacked by cold nitric acid; analysis gave: Fe 62·96, Ni 0·16, Co 0·02, S 36·25, P 0·02, C trace.

L. J. S.

Nininger (H. H.). *A new meteorite from Ballinger*[,] *Texas.* Journ. Geol. Chicago, 1929, vol. 37, pp. 88–90, 3 figs.

No particulars are given of the history of this mass of iron weighing 1250 grams. The polished and etched surface shows variously oriented granules with Neumann lines. Schreibersite and troilite are also shown. Analysis by F. G. Hawley gave: Fe 91·48, Ni 6·54, Co 0·48, Cu 0·07, Cr, Mg traces, P 0·26, S 0·01, SiO_2 0·12, C 0·09, O 1·03 (as Fe_2O_3 3·21, NiO 0·30) = 100·08; platinum 0·19 oz. per ton.

L. J. S.

Tschirwinsky (Peter) [= Chirvinsky (P. N.)]. *Petrographische Untersuchung des Meteorits von Glasatowo, bei der Stadt Kaschin, Gouv. Twer in Rußland, gefallen am* 14. (27.) *Februar* 1918. Centr. Min., Abt. A, 1928, pp. 327–334, 3 figs.

The Glasatovo meteoric stone [M.A. **2**–258] is a veined grey chondrite, with numerous small (up to 1 mm., exceptionally 3–4 mm.) chondrules, and blebs and veins of troilite. Micrometric analysis of a series of thin sections gives the mineralogical composition as pyroxene + olivine 69·94, nickel-iron 19·65, troilite 10·41 % by weight. The pyroxenes are clinobronzite (or clinoenstatite) and enstatite-diopside.

L. J. S.

Ducloux (Enrique Herrero). *Datos químicos sobre la piedra meteórica de Hinojo (prov. de Buenos Aires).*[1] Rev. Fac. Quím. Farm. Univ. Nac. La Plata, 1928, vol. 5, pt. 2, pp. 1–7, 4 pls.

A weathered stone of 1155 grams was found near the railway station Hinojo; few particulars of the find are available. The texture is heterogeneous; sp. gr. 3·407–3·411. From analyses of the different fractions the bulk composition is: Fe 6·61, Ni 0·27, Co 0·01, S 0·54, P 0·03, SiO_2 34·33 Al_2O_3 2·22, Cr_2O_3 trace, Fe_2O_3 16·53, FeO 12·29, NiO 1·39, CoO 0·04, MnO 0·59, MgO 20·04, CaO 2·27, Na_2O 1·52, K_2O 0·19, P_2O_5 0·44, H_2O and loss 0·69, corresponding with the mineralogical composition: felspars 11·06, pyroxenes 26·17, olivine 30·46, magnetite 22·73, apatite 0·93, troilite 1·49,

[1] Reprints of these two papers bear on the wrapper the title: 'Notas sobre meteoritos Argentinos. IV.—Piedra meteórica de Hinojo. V.—Siderita El Mocoví.' [Cf. M.A. **3**–388.]

nickel-iron and schreibersite 6·92. The stone is classed with the 'travisose' type of O. C. Farrington. L. J. S.

Ducloux (Enrique Herrero). *Nota sobre el meteorito El Mocoví.*[1] Rev. Fac. Quím. Farm. Univ. Nac. La Plata, 1928, vol. 5, pt. 2, pp. 8–12, 3 pls.

The El Mocoví iron [M.A. **3**–388], measuring 73 × 61 × 53 cm. and weighing 732 kg., was found in August 1925 at Los Guanacos, 15 km. S.E. of the station Gancedo in the Chaco. Polished and etched surfaces show a granular structure, the different orientation of the grains being shown by the prominent Neumann lines. There are small inclusions of silicates with troilite, schreibersite, and graphite. The iron is classed as an ataxite poor in nickel. Analyses I and II of fragments, and III and IV of turnings; also precious metals (Ir, Ru, Os) 0·035–0·087, Cr traces; sp. gr. 7·632–7·716.

	Fe.	Ni.	Co.	Mn.	S.	P.	Graphite.	Silicates.
I.	—	5·05	0·25	trace	0·12	0·16	trace	3·07
II.	93·14	5·42	0·30	trace	0·13	0·17	—	0·47
III.	93·13	5·68	0·30	0·01	0·14	0·17	0·24	0·21
IV.	92·68	6·18	0·31	0·02	0·15	0·16	0·20	0·06

L. J. S.

Ducloux (Enrique Herrero). *Datos sobre la piedra meteórica de Cacharí.* Rev. Fac. Quím. Farm. Univ. Nac. La Plata, 1928, vol. 5, pp. 13–25, 5 pls.

This meteoric stone, found in May, 1916, near the railway station Cacharí in the Azul district of the province of Buenos Aires, weighed 23,560 grams as received and its original weight was about 24 kg. Sp. gr. 3·13. It has been described as an eucrite by A. Lacroix [M.A. **3**–253, **3**–392]. It shows laths of white felspar (Ab_1An_4) in a ground of granular yellow pyroxene with an ophitic or brecciated structure. Veins of black glass (*d* 2·974, *n* 1·612) penetrate the mass. Analysis gave SiO_2 48·47, TiO_2 0·07, Al_2O_3 13·94, Cr_2O_3 0·06, Fe_2O_3 0·24, FeO 19·80, NiO trace, MnO 0·78, MgO 6·84, CaO 8·62, Na_2O 0·92, K_2O 0·13, P_2O_5 0·06, SO_3 0·06, S trace, H_2O 0·20, corresponding with felspar 41·78, diopside 7·55, hypersthene 47·27, olivine 2·50 %. L. J. S.

Ducloux (Enrique Herrero) & Pastore (Franco). *El meteorito de Renca (provincia de San Luis).* Rev. Fac. Quím. Farm. Univ. Nac. La Plata, 1929, vol. 5, pp. 111–122, 2 pls.

This stone was observed to fall at 15 h. on June 20, 1925, in the field El Recuerdo near the station Renca on the Pacific rail-

[1] See note 1 on p. 119.

way, Argentina, and several fragments were picked up within a radius of some kilometres. The total weight is about 300 grams; sp. gr. 3·410–3·411. It is a chondrite consisting of olivine, enstatite, clinoenstatite, and troilite, and is very similar to the La Colina and Santa Isabel stones [M.A. **3**–388–9]. Analyses of the magnetic (9·06 %) and non-magnetic fractions give the following bulk composition: Fe 7·79, Ni 0·79, Co 0·05, S 2·78, P 0·01, SiO_2 38·39, TiO_2 trace, Al_2O_3 3·03, Cr_2O_3 0·62, Fe_2O_3 trace, FeO 20·80, NiO 1·13, CoO trace, MnO 0·78, MgO 20·05, CaO 1·44, Na_2O 2·37, K_2O 0·58, SO_3 0·06, P_2O_5 trace. From this composition the stone is classed as 'rencose'.

L. J. S.

Ducloux (E. Herrero). *El hierro de Sumampa y otros pseudo-meteoritos.* Rev. Fac. Quím. Farm. Univ. Nac. La Plata, 1928, vol. 5, pt. 1, pp. 77–81, 4 pls.

A mass of iron, weighing 3,120 grams, from Sumampa, province of Santiago del Estero, Argentina, has the structure of manufactured iron with graphite, pearlite, and cementite, and it contains no nickel or cobalt. Other pseudo-meteorites in the National Museum at Buenos Aires are: (1) from Atacama, shown on analysis to consist of silver chloride and native silver; (2) from Chaco santafecino, consisting of limonite. L. J. S.

Merrill (George P.). *Concerning the origin of the metal in meteorites.* Proc. U.S. Nat. Mus., 1928, vol. 73, art. 21, 7 pp., 3 pls.

The structure of meteorites suggests that the metallic portion is a later introduction at a temperature less than the melting-point of the silicates. A possible source is in the reduction of ferrous chloride (lawrencite). 'Meteorites are unmistakably volcanic products.' L. J. S.

Smith (S. W. J.), Dee (A. A.), & Young (J.). *The mode of formation of Neumann bands. Part I.—The mechanism of twinning in the body-centred cubic lattice. Part II.—The evidence that the bands are twins. Part III.—The movement from which the twinning results.* Proc. Roy. Soc. London, Ser. A, 1928, vol. 121, pp. 477–513, 6 pls., 13 text-figs.

Neumann lines are twin-lamellae produced by shearing parallel to the twelve directions of the form (112). Their geometry is discussed in detail. Polished sections of the Coahuila meteoric iron etched with copper ammonium chloride showed etch-pits of various shapes (well illustrated on the plates under a magnification of 1680) with the help of which the Neumann lines were oriented. L. J. S.

Leonhardt (J.). *Die morphologischen und strukturellen Verhältnisse der Meteoreisen im Zusammenhang mit ihrem Entwicklungsgang.* Neues Jahrb. Min., Abt. A, 1928, vol. 58, pp. 153–212, 2 pls., 9 text-figs. [See M.A. **3**–533.]

Lacroix (A.). *Sur l'existence de tectites au Cambodge ; leur morphologie.* Compt. Rend. Acad. Sci. Paris, 1929, vol. 188, pp. 117–121.

—— *Sur la composition chimique des tectites, et en particulier de celles du Cambodge.* Ibid., pp. 284–288.

Glassy bodies resembling billitonites have been found in lateritic soil near the village of Smach (or Schmach) in northern Cambodia, French Indo-China. They range in weight mostly from 2 to 40 grams (an exceptional specimen 630 grams), and are of various shapes, flattened balls, disks, &c., with cup-shaped and channelled depressions on the glossy black surface. The glass sometimes contains spherical bubbles. The material used for analysis I had sp. gr. 2·422, n_{Na} 1·5063, melting-point 750–1200°; analysis II, also by Raoult, is of a billitonite from Billiton; and III of a tektite from Malaya described by A. Damour in 1844 as having burst from pressure of enclosed gas when cut open. Previous analyses of tektites are tabulated in three groups: (1) Darwin glass or queenstownite; (2) moldavites from Bohemia and Moravia; and (3) australites and billitonites, with the tektites from Cambodia. Several new determinations are given of the density (2·339–2·458) and refractive index (n_{Na} 1·4877–1·5178) of the different types of tektites.

	SiO_2.	TiO_2.	Al_2O_3.	Fe_2O_3.	FeO.	MnO.	MgO.	CaO.	Na_2O.	K_2O.	H_2O.	Total.
I.	72·08	0·78	13·21	0·37	4·47	0·13	1·92	2·42	2·14	2·49	0·26	100·27
II.	70·28	1·10	12·67	0·20	5·28	0·19	2·62	3·92	1·71	2·32	0·05	100·35
III.	70·08	0·79	13·61	0·15	4·81	0·15	2·16	3·48	1·99	2·44	0·08	99·84

L. J. S.

Paneth (Fritz). *Über den Helium-Gehalt und das Alter von Meteoriten.* Zeits. Elektrochemie, 1928, vol. 34, pp. 645–652, 3 figs.

Helium was isolated by dissolving the meteoric irons in acid or by fluxing the stones in a special apparatus out of contact with air. In six irons the amount ranged from 1·2 (Toluca) to 20 (Nelson County) $\times 10^{-6}$ c.c. The Savik iron [M.A. **3**–535], however, yielded only 2×10^{-10} c.c. helium. The radium content as determined by previous observers appears to decrease with the increasing helium content from 21 (Toluca) to 1·8 (Nelson County) $\times 10^{-14}$ gram per gram of

material. From the ratio of helium to radium ages ranging from 16 (Toluca) to 2600 (Nelson County) million years are deduced.

L. J. S.

Tscherkas (W.) [= Cherkas (V.)] & Tschirwinsky (P.) [= Chirvinsky (P. N.)]. *Knotenlänge des Eukrits von Béréba, gefallen 1924, und die empirische Formel von G. Tschermak für das Eintreffen gleichartiger Meteorite.* Centr. Min., Abt. A, 1928, pp. 288–290.

Astronomical, showing a relation between longitude and the periodicity of the falls of the eucrites Stannern (1808), Jonzac (1819), Juvinas (1821), Peramiho (1899), and Béréba (1924), but only when the formula of G. Tschermak (1907) is modified. L. J. S.

Rock-forming Minerals and Petrology.

Bowen (N. L.). *The evolution of the igneous rocks.* Princeton (Princeton University Press), 1928, x + 334 pp., 82 figs. Price $5·00 (23*s.*).

This book is based on a series of lectures given by the author in 1927 at Princeton. The word 'evolution' is here used to indicate a process of derivation of rocks from a common source. In this process of derivation fractional crystallization is shown to be the controlling factor, and the common source for most rocks to be a basaltic magma. In the first ten chapters facts determined in the laboratory are directly applied to the natural problems. It is shown that fractional crystallization can produce from basaltic magma rock-series such as do actually occur. The importance of reaction series, both continuous and discontinuous, is very considerable, and the extent to which reaction takes place during cooling has a profound effect on the course of crystallization. Glassy rocks have a much more restricted range of composition than partly crystalline rocks. Aphanitic rocks, less basic than basalt, are derived by simple 'liquid descent', but the porphyritic members of a rock series introduce complications owing to the separation or accumulation of phenocrysts. This kind of crystal sorting is responsible for such rocks as the porphyritic olivine-basalts, peridotites, and anorthosites. No magmatic liquid equivalent to these rocks is derivable from the basaltic magma. The role of assimilation is discussed in an important chapter. Inclusions are shown to exert an

effect not by direct solution in the liquid but by reaction accompanied by precipitation. On less sure foundations rest the subjects considered in the second part of the book; but as this deals with the alkali-rocks and some lamprophyres and melilite-bearing rocks, on resorption, and the role of volatile constituents, it will be read with no less interest than the better established and better known first part. W. C. S.

Shand (S. J.). *Instructions for using the quantitative mineralogical classification of eruptive rocks proposed by S. J. Shand.* London (T. Murby & Co.) & New York (D. Van Nostrand Co.), 1929, 16 pp. Price 1*s.* 3*d.*

In this booklet Professor Shand explains his method of applying the quantitative classification proposed in his much discussed 'Eruptive rocks' (M.A. **3**–317). The reader who uses this explanation as an introduction to Chapters VII to XIV of the main work will find his study of the system greatly facilitated. One objection that has been made to Professor Shand's system is the difficulty of determining the relative proportions of orthoclase, albite, and anorthite molecules in the felspars. It is pointed out that the exact determination of these proportions is only necessary when certain limiting values are approached, and the author describes how sufficiently accurate estimations can be made in other cases. Extinction-angle on cleavage fragments, density, flame tests, and micro-chemical tests are all available if the felspar can be isolated. For the 'dyscrystalline' rocks an estimate can be based on a bulk chemical analysis, the calculations for which are almost identical with those used in calculating the 'norm' in the American ('C.I.P.W.') quantitative system. W. C. S.

Shand (S. J.). *The classification of a glassy rock: the pitchstone of Wormit, Fifeshire.* Geol. Mag. London, 1929, vol. 66, pp. 116–121.

To demonstrate the application of his quantitative mineralogical classification to glassy rocks the author has studied the pitchstone of Wormit considered by J. W. Judd to be a dacite-pitchstone or mica-dacite. Mineralogical study and calculation from a chemical analysis lead independently to the classification of this glassy rock as a peraluminous soda-rhyolite (variety rhyodacite). The example is a difficult one, as the proportions of orthoclase and anorthite are

nearly equal. The author has studied the analyses of glassy rocks in Washington's tables and finds 80 % of them are glasses of oversaturated rocks. He indicates how micro-chemical tests, flame reactions, specific gravity, and refractive indices can be used to classify varieties of glassy rocks, and gives very useful details for applying the flame and micro-chemical tests. [F. A. Bannister's recent work on glasses (Min. Mag. **22**–136) seems to indicate that observations of density combined with determinations of refractive index and dispersion may provide means for quite close estimates of composition.] W. C. S.

Burri (Conrad). *Kritische Zusammenfassung unserer Kenntnisse über die Differentiationstypen postmesozoischer Vulkangebiete.* Schweiz. Min. Petr. Mitt., 1927, vol. 7, pp. 254–310, 16 figs.

The author gives a short history of the setting up of two main provinces of eruptive rocks—'atlantic' and 'pacific', the later criticisms to which this broad generalization was subjected, and the attempts to introduce other 'provinces', culminating in the introduction of P. Niggli's method for the comparison of petrological provinces and the creation for the eruptive rocks of the mountain-chains surrounding the Mediterranean of a threefold division into 'atlantic', 'pacific', and 'mediterranean'. This threefold division is now found to hold also for all the late-Mesozoic and Tertiary volcanic rocks. The author has studied some 3,000 carefully selected analyses. Space has not allowed of the publication of the numerous figures and diagrams, but the study of the rocks of the north British Tertiary province is given as an example, and the 'Niggli values' for 179 analyses from the north British province (Mull, Skye, Rum, and Ardnamurchan), Madagascar, Rodriguez, Reunion, and Mauritius are tabulated and plotted in differentiation-diagrams. The analyses from the north British Tertiary province fall into three series, which correspond approximately with the three magma-series of the Mull lavas. The undifferentiated normal Mull magma is compared with the Deccan basalts. The general distribution of the 'atlantic', 'pacific', and 'mediterranean' series in relation to regions of orogenic movement is outlined. The continued use of these names for the three series of eruptive rocks is defended, and the author indicates lines of inquiry by which petrologists may come to understand the causes of the observed connexion between the distribution of rocks of these three series and the tectonic processes. W. C. S.

Wahl (Walter). *Contributions to the chemistry of igneous rocks. Chemical equilibria in cooling rock magmas as depending on the constitution of the silicates.* Fennia (Bull. Soc. Géogr. Finlande), Helsingfors, 1928, vol. 50, no. 29, 32 pp.

In the crystallization of a cooling rock-magma, at the highest temperatures the alumino-silicates of comparatively simple constitution, in which aluminium shows the co-ordination number 4, are almost exclusively stable, together with simple orthosilicates, aluminates, iron oxides, and silica. As the temperature sinks, metasilicates are formed, and then aluminium kernels of co-ordination number 6 become stable in certain combinations, and addition reactions give rise to the amphiboles, micas, and sodalite group, and subsequently minerals of the melilite and garnet groups and analcime may crystallize. Water-vapour (dissolved water in the magma) and other volatile constituents may now take a further part, giving epidote, chlorite, scapolite, &c., and finally zeolites, calcite, &c., are formed in the cavities of the already solid and comparatively cool rock. The essential reaction is the conversion of 4-co-ordinate aluminium minerals into 6-co-ordinate as the temperature falls, by addition of silica, ortho- and meta-silicates, a second molecule of the same or another alumino-silicate, water, carbon dioxide, sulphur trioxide, hydrochloric acid, &c. [Cf. M.A. **3**–475.] M. H. H.

Wahl (Walter). *Contributions to the chemistry of igneous rocks II. Eutectics and the crystallization of igneous rocks.* With (pp. 19–20) *Note on the bearing of eutectic surfaces on crystallization-differentiation.* Compt. Rend. Soc. Géol. Finlande, 1929, no. 2 (Bull. Comm. Géol. Finlande, 1929, no. 87), 20 pp., 8 figs.

A review is given of heterogeneous equilibria in eutectic systems. Systems containing one mixed-crystal series crystallize along a eutectic curve; whilst those containing two mixed-crystal series, not soluble in each other in the crystalline state, crystallize on eutectic surfaces. The theory of eutectic surfaces explains the occurrence in nature of great numbers of related rocks built up of the same minerals in varying proportions, forming rock families. L. J. S.

Greig (J. W.). *On the evidence which has been presented for liquid silicate immiscibility in the laboratory and in the rocks of Agate Point, Ontario.* Amer. Journ. Sci., 1928, ser. 5, vol. 15, pp. 375–402, 10 figs.

The spherical structures in these rocks cannot be explained as due

to the formation of immiscible liquids, but are consistent with radial crystalline growth of a spherulitic character. A reply is made to criticism by T. L. Tanton (1928) in his discussion on the Agate Point rocks. A. F. H.

Larsen (Esper S.). *The temperatures of magmas.* [Presidential address.] Amer. Min., 1929, vol. 14, pp. 81–94.

The evidence for estimating the temperatures of magmas is reviewed, with many references to the literature. Direct readings for molten basaltic lavas range from 750° to over 1200° C. Rocks melted in the laboratory require a higher temperature, owing to the absence of mineralizers. The melting-points of minerals may be apparently lowered by reaction with other minerals. Inversion-temperatures of minerals (forms of silica, &c.), temperature at which they break down, unmixing of solid solutions, and the action of magmas on rock inclusions are considered; but these require a correction for pressure. Contrary to common opinion, rhyolitic magmas have a lower temperature (about 600–700°) than basaltic magmas (usually 800–900°). L. J. S.

Drugman (Julien). *Sur des macles nouvelles du quartz de haute température (quartz-β).* Bull. Soc. Franç. Min., 1928, vol. 51, pp. 187–192, 1 pl.

Some hitherto doubtful groupings of high-temperature β-quartz from the Esterel Mts., France, have been elucidated by comparison with the twinned crystals from Cornwall [Min. Mag., **21**–366]. They are twinned on $(11\bar{2}2)$, $(10\bar{1}1)$, $(10\bar{1}2)$, $(30\bar{3}2)$, and $(21\bar{3}3)$.

L. J. S.

Barth (Tom.). *Über den monoklinen Natronfeldspat.* Zeits. Krist., 1929, vol. 69, pp. 476–481, 2 figs.

After showing that no reliance can be placed on earlier descriptions of monoclinic crystals with the composition of albite, and called barbierite, the author describes such a mineral from the island of Seiland, south of Hammerfest in northern Norway, which consists of submicroscopic triclinic twin-lamellae. H. H.

Erdmannsdörffer (O. H.). *Über Disthen-Andalusitparagenesen.* Sitz. Heidelberg. Akad. Wiss. Math.-naturwiss. Kl., 1928, Abh. 16, 8 pp., 1 pl., 2 text-figs.

Evidence is given to show that the derivation of kyanite from andalusite by dynamometamorphism is doubtful. Instances where

such a cause is not a possible one are described from Lisenz, Sellrain valley, Tirol, and from Landarenca, Val Calanca, Tessin. The relative orientation of kyanite and andalusite in a composite crystal from Landarenca has been determined on the Fedorov stage.

W. C. S.

Lonsdale (John T.). *Dipyrite and associated contact minerals from the Franklin Mountains of Texas.* Amer. Min., 1929, vol. 14, pp. 26–32.

A 25-foot zone of dipyre, with small amounts of garnet, diopside, calcite, microperthite, and oligoclase occurs between granite and limestone in El Paso county. The dipyre is pale greyish-blue and forms bladed crystals up to 10 inches long. It is optically uniaxial, ω 1·553, ϵ 1·543, and has a good prism cleavage. Blocks of limestone included in the granite are completely converted into diopside (α 1·680, β 1·690, γ 1·705, $\gamma : c = 41°$) or garnet. Farther away from the contact, olivine (forsterite) appears in the crystalline limestone. L. J. S.

Ross (Clarence S.). *Sedimentary analcite.* Amer. Min., 1928, vol. 13, pp. 195–197.

The material described resembles a fine-grained friable green sandstone and occurs in beds evidently as a Quaternary lake deposit. It consists almost entirely of small (0·04–0·10 mm.) crystals of analcime, often separate and developed as perfect trapezohedra, coated with a thin film of glauconitic material. Small amounts (less than 1 %) of quartz, fresh plagioclase, and augite are present. The analcime has sp. gr. 2·26, n 1·483, and contains cloudy inclusions probably of opaline silica. Analyses show the analcime ratio $Al_2O_3 : Na_2O$, but with an excess of silica and water, probably due to the opal inclusions. The material has probably been formed by the action of lake water containing sodium salts on colloidal clay or perhaps on bentonite derived from volcanic ash. L. J. S.

Smyth (C. H., *Jr.*). *The genesis of alkaline rocks.* Proc. Amer. Phil. Soc., 1927, vol. 66, pp. 535–580.

The views expressed since the author's earlier (1913) paper are reviewed, and it is maintained that alkali-rich magmas have been developed by the action of primary volatile constituents under conditions of tectonic stability. The assimilation of limestone and other rocks is not a factor of importance. L. J. S.

Gillson (Joseph L.). *On the origin of the alkaline rocks.* Journ. Geol. Chicago, 1928, vol. 36, pp. 471–474.

The author believes that the process of albitization, now recognized as a common feature accompanying granite intrusions, furnishes a key to the genesis of alkali-rich rocks. Emanations rich in soda and alumina may under favourable conditions desilicate a granite magma and enrich it in soda and alumina, so that nepheline may crystallize out. L. J. S.

Larsen (Esper S.). *A hydrothermal origin of corundum and albitite bodies.* Econ. Geol., 1928, vol. 23, pp. 398–433, 4 figs.

A review is given of the occurrences of dikes of albitite and plumasite penetrating peridotites, and the arguments for and against the theory that these have originated by the desilication of a granitic magma by the surrounding basic rock are considered in detail [M.A. **1**–282, **2**–80, **3**–84, **4**–47]. It is held that such dikes are more probably of hydrothermal origin. L. J. S.

Larsen (Esper S.) & Pardee (J. T.). *The stock of alkaline rocks near Libby, Montana.* Journ. Geol. Chicago, 1929, vol. 37, pp. 97–112, 1 fig.

The larger part of the stock ($3\frac{1}{2} \times 2\frac{1}{2}$ miles) consists of pyroxenite, which in places carries much apatite (up to 10 %) and magnetite (10 %), and it grades into a biotite-rock. Nepheline-syenite and syenite are later, and later still are small dikes of granite. All these rocks are extensively altered by hydrothermal action and penetrated by quartz veins. The biotite is altered to vermiculite [M.A. **3**–78], and the quartz veins carry vanadiferous aegirine, zeolites, cancrinite, strontianite, celestine, &c. L. J. S.

Osann (A.) [1859–1923]. *Über Titanitfleckengranite.* Neues Jahrb. Min. 1923, vol. 48, pp. 223–239, 2 pls., 4 text-figs.

The author describes three occurrences of 'spotted granite' which, in common with the examples described by Geijer from Stockholm and by Lacroix from Lake Caillouas (Hautes-Pyrénées), have round light-coloured patches with cores of well-developed crystals of sphene. The three new records are from Fürstenstein in the Bayerischer Wald, Aigen on the Grosse Mühl in Upper Austria, and in the Striegau granite in Prussian Silesia. In all cases the 'sphene-spots' occur in basic inclusions, and in biotite-rich and hornblendic rocks of granitic

or quartz-dioritic composition. The light patches are free of biotite and hornblende, and the relative amounts of quartz and felspar do not seem to differ from those in the rest of the rock. The sphene is in part at least younger than the felspar. These patches are probably related to the orbicular structures in many granites and possibly the 'sphene-spots' represent the commencement of the formation of spheroids. Geijer thought the growth was from without inwards, but the author thinks this improbable. W. C. S.

Berry (J. Allan). *The volcanic deposits of Scinde Island. With special reference to the pumice bodies called chalazoidites.* Trans. New Zealand Inst., 1928, vol. 59, pp. 571–608, 3 pls., 5 text-figs.

After a brief account of the pumiceous clays and ash forming the mid-Pliocene to Recent volcanic deposits of Scinde Island, near Napier, North Island, New Zealand, the author devotes the remaining thirty pages of his paper to a minute account of the 'chalazoidites' found in abundance in three layers of the deposits, and to an exhaustive discussion of their origin. The 'chalazoidites' are 'ellipsoidal-shaped bodies composed of pumice varying in size from about a pin's head up to about half an inch across'. They usually contain a nucleus with a small central portion of looser texture, concentric layers of alternating density surrounding the nucleus, and an outer layer of much greater strength. Bodies of this kind have been referred to variously as 'pisolite', 'lapilli', mud-balls, or drops of mud, and notes are given on papers recording their occurrence. The author now proposes the name chalazoidite from χαλαζοειδης, believing that they have been formed in very much the same manner as a hailstone. Pairs of chemical analyses of chalazoidites and of the pumiceous matrix in which they lie show no marked differences, the greatest difference between any pair shown being 0·62 % SiO_2. W. C. S.

Phemister (T. C.). *A comparison of the Keweenawan sill-rocks of Sudbury and Cobalt, Ontario.* Trans. Roy. Soc. Canada, 1928, ser. 3, vol. 22, sect. 4, pp. 121–197, 4 pls., 7 text-figs.

Detailed petrographical descriptions are given of the quartz-diabase occurring as large sills intrusive into the Keewatin in these areas. The quartz forms a micrographic intergrowth with an acid plagioclase, and as this increases in amount the rock may grade into

a micropegmatite. The pyroxenes are of several kinds. (1) A monoclinic pyroxene striated parallel to the basal plane, with α 1·684, β 1·688, γ 1·704, $\gamma : c = 40{\cdot}7°$, 2E 73–114°. (2) An orthorhombic pyroxene with 2E 150°. (3) A monoclinic magnesian pyroxene, with α 1·666, β 1·671, γ 1·677, 2V 75°; analysis gave SiO_2 51·57, TiO_2 0·29, Al_2O_3 6·93, Fe_2O_3 0·00, FeO 12·95, MnO 0·22, MgO 18·20, CaO 7·90, Na_2O 0·80, K_2O 0·11, $H_2O(+)$ 1·01, $H_2O(-)$ 0·57 = 100·55. (4) Fine intergrowths of monoclinic and orthorhombic pyroxenes.

L. J. S.

Washington (Henry S.). *Petrology of the Hawaiian Islands: I. Kohala and Mauna Kea, Hawaii.* Amer. Journ. Sci., 1923, ser. 5, vol. 5, pp. 465–502, 1 fig.

—— —— *II. Hualalai and Mauna Loa.* Ibid., 1923, vol. 6, pp. 100–126.

—— —— *III. Kilauea and general petrology of Hawaii.* Ibid., 1923, vol. 6, pp. 338–367.

—— —— *IV. The formation of aa and pahoehoe.* Ibid., 1923, vol. 6, pp. 409–423, 3 figs.

—— & Keyes (Mary G.). —— *V. The Leeward Islands.* Ibid., 1926, vol. 12, pp. 336–352.

—— —— —— *VI. Maui.* Ibid., 1928, vol. 15, pp. 199–220.

The author has set out to study the Hawaiian Islands as a comagmatic unit and to investigate the petrological relations of the several islands. The first paper of this series contains important statements on nomenclature and particularly on the quantitative distinction adopted for andesite and basalt. For rocks with less than 12·5 % of femic minerals it was proposed in paper I to use the name oligoclasite, but this proposal was withdrawn in VI and oligoclase-andesite substituted. Ultrabasic basalts with abundant phenocrysts of olivine and augite, called picritic basalt by Whitman Cross, are described as picrite-basalt. For some porphyritic olivine-basalts it is suggested that Dana's old name chrysophyre should be revived, and basalts with phenocrysts of olivine are described as chrysophyric. Porphyritic and non-porphyritic rocks are described as phyric and aphyric respectively. It is important to note that throughout this nomenclature the name of the felspar prefixed to the rock name is that of the 'normative' plagioclase. As regards the use of the hyphens the practice differs entirely from that advocated by the Committee on British Petrographic Nomenclature, the principle adopted being to hyphenate like

names and not to hyphen mineral names to rock names, e. g., olivine-oligoclase andesite, picrite-basalt. The general petrography of Hawaii is discussed in III and averages for the composition of the lavas are calculated. Remarks under general petrology in VI are of particular interest. The author comments on the continued use of the terms 'Atlantic' and 'Pacific' for the alkalic and calcic or sub-alkalic suites. C. Burri's recent contributions on this subject are, however, not mentioned [M.A. **3**–387, **4**–125] and perhaps have not been taken into account. The following is a list of the lavas described and analysed from the several islands using the names as given by the author:

Kilauea.—Ancient lavas (previous to 1789) include the 'basaltoids' of O. Silvestri and his 'kilaueite'—an olivine-basalt. These rocks are now described as labradorite basalt, olivine basalt, and picrite-basalt (5 new analyses). Recent lavas (since 1789) include labradorite basalt and picrite-basalt, the former appearing in two facies: crystalline, aa and pahoehoe, and glassy, 'Pele's hair' and 'Pele's tears'. The chemical differences between aa and pahoehoe are discussed in IV.

Kohala.—Aphyric oligoclase andesite (kohalaite, of J. P. Iddings), aphyric olivine-oligoclase andesite, feldspar phyric basalt (andesine basalt), aphyric basalt (11 analyses).

Mauna Kea.—Andesine andesite, aphyric andesine basalt, ophitic andesine basalt, aphyric labradorite basalt, feldspar phyric basalt, chrysophyric basalt, picrite-basalt (12 analyses).

Hualalai.—Olivine basalt, aphyric basalt, feldspar phyric basalt, gabbro, trachyte (containing acmite) (7 analyses).

Mauna Loa.—Recent: Aphyric andesine basalt, chrysophyric oligoclase basalt, picrite-basalt (7 analyses). Ancient: Four analyses are quoted from the unpublished work of W. O. Clark and L. F. Noble. Aphyric labradorite basalt, ophitic olivine basalt, feldspar phyric basalt, chrysophyric picrite-basalt.

Maui.—Gabbro, olivine basalt, labradorite-andesine basalt, oligoclase andesite, anorthoclase trachyte from Kukui volcano (West Maui); and nephelinic andesite-basalt, chrysophyric basalt, and limburgitic basalt, from Haleakala (East Maui). Fifteen analyses are quoted.

The Leeward Hawaiian Islands rocks are described in V. They represent the tops of submerged volcanoes. The lavas are—in order of abundance—olivine-labradorite basalt, picrite-basalt, olivine-free

labradorite basalt, and andesine basalt. The islands investigated are Niihau, Nihoa, Necker Island, La Pérouse Rock, and Gardner Island (18 analyses). W. C. S.

Washington (Henry S.). *The lavas of Barren Island and Narcondam.* Amer. Journ. Sci., 1924, ser. 5, vol. 7, pp. 441–456, 3 figs.

Brief descriptions are given of these two small volcanic islands in the Bay of Bengal, and rocks collected by F. R. Mallet in 1884 are described. Chemical analyses are given of augite-andesite from Barren Island and of hornblende-dacite from Narcondam.

L. J. S.

Fleet (W. F.) & Smithson (F.). *On the occurrence of dark apatite in some British rocks.* Geol. Mag. London, 1928, vol. 65, pp. 6–8.

Grains of apatite with dark purplish cores have been recorded from sedimentary rocks of the midlands of England and from the Old Red Sandstone of the Cardiff area. It is suggested that they may have been derived from the Leinster granite. [Cf. Min. Mag. **22**–92.] L. J. S.

Skerl (J. G. A.). *Notes on the petrography of the Northampton ironstone.* Proc. Geol. Assoc. London, 1927, vol. 38, pp. 375–394, 1 fig.

The Liassic iron-ores of Northamptonshire consist of chalybite and chamosite with variable amounts of admixed sand and clay. A study of the distribution of the included grains of heavy minerals shows that garnet, staurolite, and chloritoid predominate in the northern portion of the ore-field, while the southern area is characterized by kyanite, sphene, and spinel. L. J. S.

Dougal (J. Wilson). *Observations on the geology of Lewis* [Outer Hebrides]. Trans. Edinburgh Geol. Soc., 1928, vol. 12, pp. 12–18, 2 pls.

A preliminary note recording the presence of granite intrusions, olivine-gabbro, serpentine, peridotite, anorthosite, basaltic dikes, and of important flinty crush belts. Figures are given of mylonite from Caitshall Hill, and of flinty crush rock from south of Bayble, Eye Peninsula. A micro-section shows stellate groups of hornblende with curving microlites of felspar and cubes of magnetite. The main mass of the island is composed of Lewisian gneiss. W. C. S.

Dick (Allan B.) [1833–1926]. *On needles of rutile in the test of Bathysiphon argenteus.* Trans. Edinburgh Geol. Soc., 1928, vol. 12, pp. 19–21, 1 pl.

Records the presence in the test of this foraminifer from the Firth of Clyde of abundant minute needles of rutile set nearly at right angles to the axis of the test, which consists of fine micaceous scales cemented with a small quantity of organic matter.

W. C. S.

Mackie (William). *The heavier accessory minerals in the granites of Scotland.* Trans. Edinburgh Geol. Soc., 1928, vol. 12, pp. 22–40.

About 200 specimens of granite have been examined. Thirty different accessory minerals are recorded and the distribution of the most important, 24 in number, is tabulated. Monazite was the primary object of the search, but important information has been obtained of the distribution of other minerals, such as xenotime, zircon, allanite, topaz, and fluorite. Certain antipathies are noted. Thus monazite and allanite rarely occur together: the latter is found most frequently in the basic or hornblendic granites, monazite replacing it in the more acid granites. Monazite is rarely found in granites containing hornblende and sphene. The bearing of the distribution found for the heavy minerals on the classification of granites is discussed briefly. W. C. S.

Harris (John W.). *The intrusive igneous rocks of the Dundee district.* Trans. Edinburgh Geol. Soc., 1928, vol. 12, pp. 53–68, 2 pls., 3 text-figs.

Intrusions in the neighbourhood of Dundee include hypersthene-dolerite, hypersthene- and quartz-bearing porphyrites, plagiophyres, oligoclase-biotite-porphyrite, and aplitic veins. Six new chemical analyses are given. Comparison with rocks from other igneous centres in Scotland indicates that the intrusions were connected with the Lower Old Red Sandstone volcanic activity. The sequence of intrusion is in the order of increasing acidity. W. C. S.

Lunn (James W.). *The intrusion of Binny Craig, West Lothian.* Trans. Edinburgh Geol. Soc., 1928, vol. 12, pp. 74–79, 2 pls.

The sill is intruded in Lower Carboniferous (Calciferous Sandstone) beds and consists of a fine-grained basalt with inclusions of quartz

grains and irregular patches of sedimentary material. It is capped by a quartz-dolerite, the contact being sharp but unchilled. Near the contact of the basalt with oil-shales the basalt emits a bituminous odour, and in the quartz-dolerite joints are coated with semi-solid crude oil. The quartz xenocrysts all show a border of augite and some have been converted completely into augite. A new analysis is given of the 'basalt of the Binny Craig type'. W. C. S.

Day (T. Cuthbert). *Chemical analyses of quartz-dolerites and segregation veins at Hound Point, North Queensferry, and Inverkeithing* [Fife]. Trans. Edinburgh Geol. Soc., 1928, vol. 12, pp. 80–86, 2 pls.

The paper describes three exposures of quartz-dolerite and gives analyses of (1) the quartz-dolerite of the main exposures; (2) the same rock close to a segregation vein; and (3) a segregation vein. No material difference is found between (1) and (2), but the silica is about 20 % higher in the segregation veins than in the quartz-dolerites. W. C. S.

Day (T. Cuthbert). *Bombs of nepheline-basanite in the Partan Craig vent, North Berwick* [Haddington]. Trans. Edinburgh Geol. Soc., 1928, vol. 12, pp. 87–89, 1 fig.

Bombs in this volcanic vent, which has been fully described by the author in an earlier paper, consist of a partly decomposed nepheline-basanite. This is abnormal in containing albite and oligoclase and probably also orthoclase. All the olivine and augite are decomposed and the chemical analysis shows that alteration has caused a loss of silica in exchange for H_2O and CO_2. W. C. S.

Miscellaneous.

Bianchi (Angelo). *Titanite di Val Devero* (Ossola). Atti Soc. Ital. Sci. Nat., 1916, vol. 55, pp. 39–150, 6 pls.

A detailed account of crystals of sphene from the gneissic rocks at various localities in the Val Devero, Piedmont. The axial ratios are deduced for crystals from each locality (but for the table of calculated angles the constants of A. Des Cloizeaux, 1862, are adopted). Forty-eight forms are noted of which the following are new for sphene: $\mathfrak{G}$ (052), $\mathfrak{p}$ (113), $\mathfrak{p}_1$ (225), m_4 (14.14.1), m_3 (22.22.1),

m_2 (27.27.1), m_1 (40.40.1), $\mathfrak{g}$ (511), $\mathfrak{F}$ ($\bar{1}22$), $\mathfrak{Z}$ ($\bar{2}45$), $\mathfrak{E}$ (174), $\mathfrak{U}$ (312), $\mathfrak{U}_1$ (13.4.10), $\mathfrak{z}$ (432), δ_1 (7.12.30), W_0 (15.8.32), W_1 (7.4.16), Λ_1 (6.2.13).

	$a : b : c.$	$\beta.$
Monte Forno, Croveo... ...	0·755235 : 1 : 0·854975	60° 13′
Monte Cervandone[1]	0·754665 : 1 : 0·85517	60 12
Passo dei Laghi	0·75467 : 1 : 0·853614	60 8½
Rossa	0·7533 : 1 : 0·858054	60 8¾
Passo del Forno, Arbola[2] ...	0·754046 : 1 : 0·854274	60 10
Forno glacier, Arbola	0·75440 : 1 : 0·854778	60 13¼
A. Des Cloizeaux (1862) ...	0·75467 : 1 : 0·85429	60 17

[1] = Cherbadung. [2] = Ofenhorn, on the Swiss maps.

L. J. S.

Bianchi (Angelo). *Augite diopsidica del Monte Cervandone in Val Devero (Ossola).* Atti Soc. Ital. Sci. Nat., 1920, vol. 59, pp. 105–124, 1 pl.

Crystals of diopside from the Italian side of Mt. Cherbadung [Min. Mag. **13**–292] showed twenty forms with new W ($\bar{1}22$), Z ($\bar{1}95$), V ($\bar{2}43$); $a : b : c = 1{\cdot}0936 : 1 : 0{\cdot}5888$, $\beta = 74°4'40''$. Extinction-angle on (010) $\gamma : c = 41°45'$; β 1·6815 (red), 1·6865 (Na), 1·6915 (blue); 2V 59½°. Analysis gave: SiO_2 53·32 [not 34·32], TiO_2 trace, Al_2O_3 0·88, Cr_2O_3 0·05, Fe_2O_3 2·05, FeO 4·63, MnO 0·11, MgO 13·57, CaO 24·75, Na_2O 0·57, K_2O 0·33, H_2O 0·20 = 100·46; sp. gr. 3·34. L. J. S.

Andreatta (Ciro). *Sulle arsenopiriti dei giacimenti minerari di Calceranica e Caldonazzo nel Trentino.* Riv. Studi Trentini Sci. Nat., 1928, vol. 9, fasc. 1, pp. 90–104, 5 figs.

——*Sull' arsenopisite di Nogarè (Trentino).* Ibid., 1928, vol. 9, fasc. 2, (reprint 12 pp.), 5 figs.

At Calceranica a pyrites vein has been worked since 1600. Crystals of mispickel found in the adjoining tale-schist are prismatic in the direction of the a-axis and show the forms $q\ n\ t\ u\ \rho\ r\ k\ m\ d$ [Dana] and new i (034); $a : b : c = 0{\cdot}6775 : 1 : 1{\cdot}1840$. Twinning on (110) and (101), the latter with stellate groups. Analysis gave S 20·77, As 45·10, Fe 33·91, Mn, Co traces = 99·78; sp. gr. 5·98–6·03. At Ronchi near Caldonazzo mispickel has recently been found in sericite- and chlorite-schists; analysis gave S 20·43, As 45·83, Fe 33·13, SiO_2 0·50 = 99·89. At Nogarè, in a lead-zinc vein, the crystals of mispickel are of two types. (1) Prismatic in the direction of the c-axis with the forms $m\ t\ k$ and new h (091), and twinned on (101). (2) Pris-

matic in the direction of the a-axis with the forms $q\,m$ and new h (091), l (2·3.12), and (1·23.0)?; $a:b:c = 0{\cdot}6783:1:1{\cdot}1910$. Analysis gave S 21·30, As 43·03, Fe 35·63, SiO_2 0·43, Pb, Zn traces = 100·38, agreeing with the formula $Fe_{22}As_{20}S_{23}$; sp. gr. 5·9–6·2 (mean 6·05). L. J. S.

Cavinato (Antonio). *Studi sul quarzo. Fenomeni di corrosione in un cristallo di quarzo del ghiacciaio del Miage (M. Bianco).* Rend. R. Accad. Lincei, Cl. Sci. fis. mat. nat. Roma, 1925, ser. 6, vol. 1, pp. 246–251, 1 fig.

A crystal of quartz from the Miage glacier, on the Italian side of Mont Blanc, shows a corrosion of the apex and of three alternate edges between the r and z faces, whereas the other areas and faces ($m\,r\,z\,s\,x$ &c.) show no signs of corrosion. The prerosion facets have the indices (14$\bar{5}$4), (41$\bar{5}$4), (81$\bar{9}$4), (61$\bar{7}$2), (41$\bar{5}$3), (62$\bar{8}$3), (17.3.2$\bar{0}$.3), (10.5.1$\bar{5}$.2), and probably (23$\bar{5}$5), (32$\bar{5}$5), (42$\bar{6}$1), (21$\bar{3}$3), (2$\bar{1}\bar{1}$2). L. J. S.

Cavinato (Antonio). *Studi sul quarzo, I cristalli di quarzo di Val Maggia e loro interessante abito pseudo-emimorfo.* Rend. R. Accad. Lincei, Cl. Sci. fis. mat. nat. Roma, 1925, ser. 6, vol. 1, pp. 323–328, 3 figs.

Crystals of quartz of the 'Tessin habit' [M.A. **3**–58] from Val Maggia, Tessin, Switzerland, present a peculiar pseudo-hemimorphic development. At one end they are terminated by the rhombohedra r and z, whereas the other end carries a series of acute (positive, or positive and negative) rhombohedra forming an elongated (trigonal or hexagonal) pyramid. Fifty-nine forms are noted, of which (14.0.1$\bar{4}$.1), (10.11.2$\bar{1}$.10), (2.11.1$\bar{3}$.2), and (19.20.3$\bar{9}$.19) are new. L. J. S.

Carpanese (Tullio). *L'epidoto del Monte Rosso di Verra (gruppo del Monte Rosa).* Rend. R. Accad. Lincei, Cl. Sci. fis. mat. nat. Roma, 1925, ser. 6, vol. 2, pp. 276–283, 349–355, 4 figs.

Greenish-yellow crystals of epidote from this locality in Piedmont show forty-one forms, of which (7.7.20), (94$\bar{2}$), (94$\bar{3}$), and (83$\bar{1}$) are new; $a:b:c = 1{\cdot}5802:1:1{\cdot}8045$, $\beta = 64°34\frac{1}{2}'$. The pleochroism is: α light yellow, β brownish-yellow, γ yellow-green. The dispersion of the index β is from 1·7519 (blue, 410 $\mu\mu$) to 1·7304 (red 720$\mu\mu$); β_{Na} 1·7364. $\alpha:c = -2°$. From the angle (22°37′) of

emergence of an optic axis through (001), $2V = 80°53'$, negative. Analysis gave: SiO_2 37·87, Al_2O_3 26·33, Fe_2O_3 10·13, CaO 24·10, H_2O 2·05 = 100·48; sp. gr. 3·343. L. J. S.

Zambonini (Ferruccio) & Caglioti (Vincenzo). *Ricerche chimiche sulla rosterite di San Piero in Campo (Isola d'Elba) e sui berilli in generale.* Gazzetta Chimica Italiana, 1928, vol. 58, pp. 131–152, 5 figs.

Small pink crystals of 'rosterite' from Elba are tabular in habit with the beryl forms *c m a* and (11.11.$\bar{2}\bar{2}$.25). They show optical anomalies with division into sectors; negative, 2E 17°10′—22°20′, with optic axial plane parallel to *m* or inclined at 10° (in the latter case suggesting monoclinic symmetry); α 1·583, γ 1·590. Analysis I shows large amounts of alkalis. Analysis II is of clear blue beryl from 'Siberia'; III of pale yellow-green beryl from Písek, Bohemia; and IV of emerald from Muzo, Colombia. Plotting RO, Al_2O_3, and SiO_2 on a triangular diagram, these and other analyses of beryl, show considerable deviations from the usually accepted formula $Be_3Al_2Si_6O_{18}$. Variations from this formula are explained as mixed crystals with R_2SiO_3 and $R_2Al_2Si_2O_8$, where R is Li_2, Na_2, K_2, Cs_2, and some Be, Ca, Mg. The small amount of water is believed to be present as inclusions or due to incipient alteration.

	SiO_2.	Al_2O_3.	Fe_2O_3.	BeO.	MnO.	MgO.	CaO.	BaO.
I.	60·42	15·65	0·77	13·21	0·74	0·14	0·39	0·19
II.	65·25	17·84	0·13	13·29	0·02	0·16	0·83	0·21
III.	65·87	17·83	0·06	13·05	0·03	0·14	0·67	0·15
IV.	65·26	17·60	0·09	13·20	0·06	0·77	0·69	0·16

	SrO.	Li_2O.	Na_2O.	K_2O.	Cs_2O.	H_2O.	Total.	Sp. gr.
I.	0·02	0·43	4·22	2·25	0·91	0·84	100·18	2·764
II.	0·06	0·10	0·63	0·18	0·13	0·98	99·81	2·688
III.	0·01	0·11	0·43	0·26	—	1·36	99·97	2·691
IV.	0·01	0·10	0·50	0·22	—	1·84	100·57	2·691

In IV also Cr_2O_3 0·077.

L. J. S.

Carobbi (G.). *Ricerche chimiche sull' olivina di Linosa (Isole Pelagie).* Rend. Accad. Lincei, Cl. Sci. fis. mat. nat. Roma. 1928, ser. 6, vol. 7, pp. 654–660.

Transparent crystals show the forms *b c m s k*, with angles $mm = 50°3'$, $kk = 98°42'$. Analysis I of greenish-yellow crystals,

sp. gr. 3·410; II of reddish-yellow, sp. gr. 3·462. Traces of SrO and BaO are also present in both. The lead is supposed to be present as an isomorphous replacement of magnesium.

	SiO_2.	Fe_2O_3.	FeO.	MnO.	NiO.	CoO.	PbO.	MgO.	CaO.	H_2O.	Total.
I.	39·16	2·98	12·43	0·21	0·12	0·13	0·20	42·70	0·96	0·98	99·87
II.	39·11	5·63	11·06	0·18	0·18	0·10	0·26	41·38	1·19	0·50	99·59

L. J. S.

Carobbi (G.). *Ricerche sulla composizione chimica della liparite.* Gazzetta Chimica Italiana, 1928, vol. 58, pp. 801–808.

A green incrustation on lava from the island of Lipari was named liparite by F. Casoria in 1846; his approximate analysis gave the formula $2CuO.3SiO_2.4\frac{1}{2}H_2O$. A new analysis, SiO_2 33·08, Al_2O_3 1·19, Fe_2O_3 1·79, MgO 2·07, CaO 0·81, H_2O (over $CaCl_2$) 16·98, H_2O 9·52, CO_2 trace, total 100·54, agrees with the chrysocolla formula $CuO.SiO_2.xH_2O$ (with $3H_2O$ in air and $1H_2O$ over $CaCl_2$). The material analysed has sp. gr. 2·080 and n 1·51. The name liparite should be kept as a rock name. L. J. S.

Carobbi (Guido). *Sulla ferrimolibdite di Bivongi (Calabria).* Rend. Accad. Sci. Fis. Mat. Napoli, 1927, ser. 3, vol. 33 (= anno 66), pp. 53–57.

A yellow film on molybdenite from Bivongi, previously described as molybdate of uranium, is proved to be ferrimolybdite (of P. P. Pilipenko, 1914). The minute needles have α or β about 1·731, $\gamma > 1·74$. Analysis, MoO_3 41·2, Fe_2O_3 14·0, H_2O (over $CaCl_2$) 4·4, H_2O (at 110°) 13·1, H_2O (at 185°) 4·4, insol (in dilute HCl) 22·4, total 99·5, gives the ratios $MoO_3 : Fe_2O_3 : H_2O = 3·25 : 1 : 11$.

L. J. S.

Carobbi (Guido). *Sulla presenza dell' atacamite fra le incrostazioni della lava Vesuviana del 1631.* Rend. Accad. Sci. Fis. Mat. Napoli, 1928, ser. 3, vol. 34 (= anno 67), pp. 78–83.

Atacamite though previously mentioned from Vesuvius has not hitherto been determined with certainty. A green powdery incrustation, associated with vesbine [M.A. **3**·363] on the lava of 1631, shows minute crystals with the forms *b m e r*, and analysis gave Cl 12·58, CuO 54·85, CaO 2·42, MgO 0·36, Al_2O_3 (with little Fe_2O_3)

0·53, K_2O 2·42, Na_2O 1·36, SiO_2 1·58, V_2O_5 0·47, H_2O (over $CaCl_2$) 1·40, H_2O 13·99, insol. 10·97, total (less O for Cl) 100·09.

L. J. S.

Chudoba (Karl). *Brushit als Neubildung an einem mittelalterlichen Skelett bei Lörrach in Baden.* Centr. Min., Abt. A, 1928, pp. 291–293, 1 fig.

Minute (1 mm.) colourless crystals of brushite were found on the beard of a skeleton unearthed from an eighth-century grave. They are tabular parallel to the (010) cleavage, perpendicular to which is the acute positive bisectrix, 2V 78–80°, β 1·541, $\beta : c = +20°$. [Cf. M.A. **3**–298.] L. J. S.

Mügge (O.). *Ueber die Entstehung faseriger Minerale und ihrer Aggregationsformen.* Neues Jahrb Min., Abt. A, 1928, vol. 58, pp. 303–348, 7 pls., 12 text-figs.

A study of fibrous and columnar structures in minerals, with theoretical considerations and many examples. Fibrous growth in rock crevices depends on the relative rates of crystallization of the mineral and the opening of the fissure. In fused masses it is related to the cooling surfaces. Fibrous structures in reaction-rims and pseudomorphs and in gels (including stalactites) are also considered. Fibrous gypsum and calcite (satin-spar) are classed under efflorescences, and the fibrous structure of chrysotile is believed to be due to translations brought about by mechanical forces. L. J. S.

Wegscheider (Rudolf). *Notiz über Makit und Hanksit.* Min. Petr. Mitt. (Tschermak), 1928, vol. 39, pp. 316–319.

The formula of hanksite has been given as $4Na_2SO_4.Na_2CO_3$ or $9Na_2SO_4.2Na_2CO_3.KCl$. The chloride is no doubt present as an impurity, and perhaps also some of the sulphate. The suggestion is made that hanksite is identical with the artificial double salt $2Na_2SO_4.Na_2CO_3$ [M.A. **3**–162], or with the double sulphate and carbonate of sodium described under the name makite by H. Abich [1] in 1846 from salt lakes near Mt. Ararat. The formula of the latter is now deduced as $4Na_2SO_4.Na_2CO_3$ with some admixed $Na_2CO_3.H_2O$ (thenardite). L. J. S.

[1] H. Abich, Bull. Cl. Physico-Math. Acad. Sci. St.-Pétersbourg, 1847, vol. 5, col. 121; Journ. Prakt. Chem. (Erdmann), 1846, vol. 38, p. 9. In the text-books the name makite is incorrectly attributed to — Adam, 1869, as a synonym of thenardite. The mineral was named from the territory of the khan of Maku, on the borders of Persia and Armenia.

Feigl (F.). *Über den Nachweis von Magnesium mit Diphenylcarbazid, insbesondere in Gesteinsproben.* Zeits. Anal. Chem. (Fresenius), 1927, vol. 72, pp. 113–119.

Feigl (F.) & Leitmeier (H.). *Eine Reaktion zur Unterscheidung von Dolomit und Magnesit.* Centr. Min., Abt. A, 1928, pp. 74–87.

Leitmeier (H.) & Feigl (F.). *Ein Nachweis von Magnesium in Silikaten.* Min. Petr. Mitt. (Tschermak), 1928, vol. 39, p. 323.

Magnesium salts that are decomposed by alkali hydroxide are coloured reddish-violet when boiled with an alcoholic solution of diphenylcarbazide $[(C_6H_5)_2(NH)_4CO]$. Magnesite gives this reaction, but dolomite, breunnerite, and mesitite react only after ignition. Dolomite is therefore regarded as a calcium magnesiocarbonate $Ca[Mg(CO_3)_2]$. The reaction can also be used as a test for magnesium in silicates after decomposition with HF or $HKF_2 + H_2SO_4$.

L. J. S.

Lee (O. Ivan). *The mineralogy of hafnium.* Chemical Reviews, 1928, vol. 5, pp. 17–37.

A summary of analyses of hafniferous zirconium minerals. The ratio $HfO_2 : ZrO_2$ is variable, from 0·007 to 0·5, but usually averages about 0·02. In the case of zircons, the hafnium content appears to increase parallel with the radioactivity (which is due to traces of thorium and uranium), and altered zircons, particularly alvite and cyrtolite, are richer than unaltered. Clerici solution (thallium malonate and formate) is suggested for separating ammonium hafnifluoride from ammonium zirconifluoride in the last stages of hafnium fractionation. A bibliography is added. M. H. H.

Papish (Jacob). *New occurrences of germanium I.* Econ. Geol., 1928, vol. 23, pp. 660–670. [Cf. M.A. **4**–88.]

A short review is given of the literature on the occurrence of germanium in minerals. Spectrographic analysis of stannite from Bolivia and Cornwall showed traces of germanium. Pyrargyrite from Colquechaca, Bolivia, showed larger amounts, in one sample about 1 % or perhaps even 3 %, and in another determined gravimetrically as 0·07 % Ge. In pyrargyrites from other localities germanium was found to be absent. [The pyrargyrite from Colquechaca is often very intimately associated with argyrodite.] Traces of germanium were also found in native copper and in 'calamine'

[? hemimorphite] from various localities. Native copper from Globe, Arizona, gave gravimetrically 0·001 % Ge. L. J. S.

Thomson (Ellis). *A new telluride occurrence in Quebec.* Univ. Toronto Studies, Geol. Ser., 1928, no. 27, pp. 11–14, 1 pl.

Small specimens of rich ore from Montbray township in the Rouyn area were examined microscopically on polished sections, and the following minerals identified: tetradymite, altaite, chalcopyrite, blende, pyrrhotine, gold, krennerite, petzite, pyrite, and chalcosine. In some specimens the krennerite predominates. L. J. S.

Shannon (Earl V.). *Xanthoconite and associated minerals from the General Petite mine, Atlanta district, Idaho.* Amer. Min., 1928, vol. 13, pp. 469–475, 4 figs.

A small specimen found in 1908, in the Roebling collection, shows minute crystals of xanthoconite, proustite, and polybasite on argentite. L. J. S.

Shannon (Earl V.). *Tschermigite, ammoniojarosite, epsomite, celestite, and paligorskite from southern Utah.* Proc. U.S. Nat. Mus., 1929, vol. 74. art. 13, 12 pp., 1 fig.

The first three minerals occur in a lignitic shale of Cretaceous age. The tschermigite is very similar to that from Wyoming [M.A. **1**–344] and gave SO_3 35·78, Al_2O_3 11·86, Fe_2O_3 trace, MgO 0·28, CaO 0·10, Na_2O 0·48, K_2O 0·48, $(NH_4)_2O$ 4·78, Cl 0·04, H_2O (110°) 25·16, H_2O (>110°) 21·68, insol. 0·04 = 100·45, agreeing with $Al_2(SO_4)_3 \cdot (NH_4)_2SO_4.24H_2O$. Ammoniojarosite [M.A. **3**–470]. Epsomite when fresh as silky fibrous masses, which on exposure become dull and friable. Analysis of air-dried material gave the formula $MgSO_4 \cdot 3H_2O$. Celestine crystals occur with paligorskite (mountain-cork) in a friable red sandstone. The fine fibres of paligorskite give straight extinction with positive elongation, n about 1·490: analysis gave SiO_2 52·55, Al_2O_3 13·64, Fe_2O_3 trace, MgO 10·63, CaO 1·39, SrO trace, H_2O (110°) 7·66, H_2O (>110°) 14·16 = 100·03, agreeing with $2MgO.Al_2O_3.6SiO_2.8H_2O$. L. J. S.

Shannon (Earl V.). *Miargyrite silver ore from the Randsburg district, California.* Proc. U.S. Nat. Mus., 1929, vol. 74, art. 21, 10 pp., 3 figs.

Specimens from the Kelly mine consist largely of miargyrite with quartz and some stylotypite (?). Analysis of massive material gave

S 19·27, Sb 42·46, As trace, Ag 36·20, Cu 0·02, Fe 0·56, Pb 0·95, insol. 0·80 = 100·26. The small (1–3 mm.) crystals are tabular parallel to (001) or (100) and are deeply striated in the zone [100, 011]. Measurement of three crystals showed 22 forms, three of which (722), (733), (433) [Dana's axes] appear to be new.

L. J. S.

Tarr (W. A.). *Doubly terminated quartz crystals occurring in gypsum.* Amer. Min., 1929, vol. 14, pp. 19–25, 3 figs.

Quartz crystals (0·1 – 20 mm.) either singly or in clusters are embedded in a pink banded alabaster near Acme in New Mexico. The colouring of the crystals, due to enclosed haematite, was taken up when the crystals were deposited from solutions permeating the gypsum. The smallest crystals show only the form *r*, *z* appears next, and finally the prism. L. J. S.

Tarr (W. A.) & Lonsdale (John T.). *Pseudo-cubic quartz crystals from Artesia, New Mexico.* Amer. Min., 1929, vol. 14, pp. 50–53, 1 fig.

Quartz crystals developed on all sides are abundant in the gypsum beds at this locality. 'Quartzoids' (*m r z*) are the commonest form; but some crystals show only the rhombohedron *r*, then resembling cubes. L. J. S.

Schaller (Waldemar T.). *The probable identity of camsellite with szaibelyite.* Amer. Min., 1928, vol. 13, pp. 230–232.

A comparison of the optical data and chemical analyses of camsellite [M.A. **1**–375, **2**–565] with those of szaibelyite [M.A. **3**–316] suggests the identity of these minerals. L. J. S.

Winchell (A. N.). *Camsellite and Szaibelyite.* Amer. Min., 1929, vol. 14, pp. 48–49, 1 fig.

The conclusion of Schaller (preceding abstract) is disputed. The refractive index β 1·620 of the original camsellite was determined by enclosing a bladed crystal in a capillary tube, so enabling the thin blade to be turned up on edge. From this value and from α 1·575 and γ 1·649 the axial angle 2V must be nearly 80° and negative, whereas szaibelyite is optically uniaxial. L. J. S.

Schwartz (G. M.). *Dyscrasite and the silver-antimony constitution diagram.* Amer. Min., 1928, vol. 13, pp. 495–503, 4 figs.

Microscopical examination of polished surfaces of a specimen of supposed native silver (Ag 81·67, Sb 10·32, As 0·44 %) show an intricate intergrowth of silver and dyscrasite (Ag_3Sb). This is discussed in connexion with the equilibrium diagram of the system Ag–Sb. The structure is probably due to the break-down of a solid solution of silver and antimony formed at a temperature above 560° C. [Cf. M.A. **1**–356.] L. J. S.

Rutherford (Ralph L.). *Anthraxolite from the Northwest Territories of Canada.* Amer. Min., 1928, vol. 13, pp. 516–518.

Shiny black, brittle material from the pre-Cambrian rocks of Union Island, Great Slave Lake, Mackenzie, gave on analysis by J. A. Kelso: C 94·25, H 1·26, N 0·78, O 1·97, S 0·42, ash 1·32. Similar material is also found in the glacial drift in Alberta. L. J. S.

MacCarthy (Gerald R.). *Tourmaline-bearing quartz from Amelia, Virginia.* Amer. Min., 1928, vol. 13, p. 531.

The black needles enclosed in quartz crystals were proved to be tourmaline, and it is suggested that in some other occurrences of 'rutilated quartz' the needles are perhaps tourmaline rather than rutile. L. J. S.

Foye (W. G.). *Manganotantalite from Portland, Connecticut.* Amer. Min., 1929, vol. 14, p. 75.

This reddish-brown mineral shows two good cleavages at right angles; it occurs embedded in felspar. Determinations by E. S. Larsen gave α 2·15, β 2·17, γ 2·25. L. J. S.

Crook (A. R.). *An Illinois record copper erratic.* Amer. Min., 1929, vol. 14, pp. 119–124, 2 figs.

Particulars are listed of nineteen masses of native copper that have been found in the glacial drift of Illinois. They have been derived from the Lake Superior region. The largest mass, weighing 1606 lb., was found in 1927. [Cf. M.A. **3**–220.] L. J. S.

Leonard (R. J.). *Green sphalerite from Sonora, Mexico.* Amer. Min., 1929, vol. 14, p. 161.

Transparent cleavage masses of blende with a fine green colour are present in specimens of silver-lead ore from Manzanal mine near Cananea. L. J. S.